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Abstract

The article describes the use of the Markov chains methodology for analysis of demographic evolution of Polish enterprises in the years 2003 - 2009. According to the results' presented in the article, flexibility of Polish companies' activity in changing economic conditions is stable. The level of migration between sectors is low and limited to several sectors. Expected company life is relatively short (on average, Polish companies exist more than twice shorter than e.g. Belgian companies subject to a study by the National Bank of Belgium). In general, the least "vital" companies may be considered companies from the transport section and then from the building industry, other services and commerce sections. Enterprises that stay on the market the longest are companies from the agricultural and industrial sectors. The mean value of the *closeness to extinction* indicator amounts to 46% for the whole population. Among all sectors and sections, non-specialised exporters have the highest average age. State-owned companies have significantly higher both the average age and the remaining lifetime than private companies. The bigger is a company the higher is its average age and average remaining lifetime.

Keywords:
Business demography, Markov chains, Transition matrix

JEL:
C81, M13, T11

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1. Introduction

Business demography constitutes a domain of science, which has recently begun to develop dynamically in the member states of the European Union. This is a field of knowledge related with dynamics underlying the establishment of new and fall of the already existing companies. Its aim is to deliver information, which may be treated, apart from GDP growth dynamics, as a barometer of national economic condition. They are quite useful indicators, as they do not only reflect the influence posed by the so-called critical factors of economic growth, but also the ones that cannot be measured, related with moods of investors and their anticipations concerning their business activity. In 2007 the European Statistical Office – Eurostat – elaborated common principles and methodology of such research (*Eurostat/OECD Manual on Business Demography Statistics*) as one of the elements within the structural enterprise statistics. Central banks in Europe are also interested in business demography. For example, the National Bank of Belgium published a complete statement on dynamics of enterprises in the form of transition matrix between sectors on its website.

An analysis of business enterprise migration between branches allows for finding dependences between internal attributes (age and size of the enterprise, sector/section in which it functions), external factors (workforce, national economic policy), and changes to the sector/section made by the enterprise. It is obvious that companies entering the market are characterised by other attributes than those that are departing. Companies that move from one section/sector to another, are likely to achieve lower profits than those that remain in one sector, but are in a considerably better situation than newly created enterprises. Distinguishing between enterprises and grouping them into homogenous groups help in further analyses.

Most empirical studies on variations in entry and exit rates are either based on survey data like the *Global Entrepreneurship Monitor* (Acs et al., 2008), business data *AMADEUS* Bureau van Dijk (Hoffman and Junge, 2006) and business registration data *World Bank Entrepreneurship Survey - WBGES* (Klapper et al., 2008; Klapper et al., 2009) or a mix of the previous (Baterlsman et al., 2005; Scarpetta et al., 2002; Ahn, 2001). Moreover, most only take into account the manufacturing sector. There is scarce evidence of studies on entrepreneurial activity that encompass simultaneously all sectors, regions and countries. Portugal is somehow an exception, where extensive research has been done in firm dynamics using mostly *Quadros de Pessoal* (Mata and Portugal, 1994; Mata et al., 1995; Mata, 1993; Mata and Machado, 1996; Gorg et al., 2000; Baptista et al., 2008; Cabral, 2007; Cabral and Mata, 2003; Baptista and Carias, 2007; Baptista and Mendonça, 2007).

There are constantly more publications appearing on the subject of macroeconomics, concerning the endogenous rate of companies' entering and departing compared to fluctuations in the economic cycle. This issue is important for several reasons. First, the basic characteristic of the economic cycle, according to Bilbiie, Ghironi, Melitz (2007), is that the rate of company entry is pro-cyclical, while the rate of exit is anty-cyclical and precedes changes in the GDP trend. Second, the increased entrance rate can work at the level of the aggregate product, strengthening economic shocks. Berentsen, Waller (2010) are analysing the DSGE model, with an endogenous entry rate and are indicating the presence of an external effect of the increased entry rate of firms on the market. A simultaneous entry on the market of a large number of firms changes, however, in a considerable way the conditions of carrying on business, which through production costs influences aggregate product in a manner difficult to predict, both by businessmen and decision makers. Also, as according to Bergin, Corsetti (2008), monetary policy has a material and underappreciated influence on adjustments of a quantitative[1] character in the enterprise sector.

According to Boguszewski (2002), the most important factors modulating or catalysing the transmission of monetary impulses to the private sector include: company size[2], balance sheet structure, share of non-bank debt, sector structure of the economy[3], legal framework and legal-organisational forms of ownership[4]. Aside from monetary policy (the National Bank's of Poland base rate, shaping the level of the cost of bank loans), other macroeconomic factors also have an influence

[1] The intensive margin is based on changes in productivity, extensive margin is based on changes in the number of producers. The final effect (aggregate product) depends on the production cost curve.
[2] See Gertler, Gilchrist (1994)
[3] See Farès, Srour (2001)
[4] See Cecchetti (1999)

on the dynamics of the enterprise sector. These are, above all, the general economy of the country (rate of GDP change, level of savings, budgetary expenses, inflation, level of unemployment, the situation with foreign trade, currency stability, etc.). These factors also include the regulation of the financial-tax system (real income tax rate, determining the level of savings possible by enterprises; level of contributions for social insurance, influencing the share of employment cost in total production value; PLN exchange rate; financial and non-financial government support; availability of banking and insurance services and legal regulations with respect to debt collection), on which, to a large extent, the ability to accumulate capital is dependent on by small and medium enterprises, in order to finance current operation and growth on their own.

The goal of this study, taking advantage of the Markov Chain method, is to present the demographic processes taking place in the population of enterprises in Poland in the years 2003-2008, on the basis of non-identifiable individual data, collected within the F-02 form of the Central Statistical Office, and an analysis of the dependence of enterprise lifetime on the market on the type of basic business activity. This method will also be used to study the dependence between the duration of enterprise existence on the market and:

- legal form (public sector /private sector),
- size (small, medium, large),
- export volume (non-exporter, exporter non-specialized, exporter specialized).

Hence, this study assumes a wider perspective than the majority of other studies regarding enterprise demographics, exclusively concentrating on the creation of new and the bankruptcy of others, without the separation in categories. The utilisation of Markov Chains allows for the evaluation of the enterprise migration phenomenon and a detailed forecast of future diversity of firms on the marketplace and the expected lifetime of a given enterprise in a given sector.

The remainder of this paper is organized as follows. Section 2 presents a brief review of the literature. Section 3 illustrates an econometric methodology. Section 4 describes the data set. Section 5 presents empirical results.

2. Litrature review

Business demography has initially become popular in the sociology of organisations (Hannan, Freeman 1989; Carroll, Hannan 2000). The theory of demography of enterprises was developed based on life tables, but the relations between age and enterprise survival rate were also searched for (Bruggeman 2001). Another stream of research is the analysis of spatial dimensions of enterprise dynamics, and specifically enterprise migration (Wissen, Gordijn 1992, Dijk, Pellenbarg 2000). An analysis of enterprise lifetimes, number of new enterprises and bankruptcy cases as well as the examination of the importance of the above mentioned phenomena to the economic growth, have also become popular. The influence of demography of enterprises on productivity and employment has been analysed by Caves (1998), Haltiwanger (2000), Ahn (2001), OECD (2003), the World Bank (2005), Scarpetta and Vodopivec (2005), and others. The research pointed to the significance of the processes involving the emergence of new companies and bankruptcies of the existing ones to the general increase in productivity which is driven by both the entries of new companies, frequently offering newer technologies and using the capital and labour resources better on one hand, and the exits of the least efficient companies from the given industry, on the other. According to the World Bank's report (2005) covering the countries from the Central and Eastern Europe, the net effect of entries of new companies (balance of results of companies' entries and exits) was positive in majority of countries under analysis, contributing to a 20%-50% of the total increase in productivity. An analysis performed by OECD in 2003 provides a similar evidence for the significance of an increase in productivity in individual companies to the changes in the productivity in general terms, as well as for contributing to the increase in productivity of entries and exits of companies. Further, the OECD's research showed that re-allocation of employment between companies (as well as the entries and exits of companies) play relatively more important role in the periods of economic downturn, primarily due to more frequent occurrence of bankruptcies of low-productive companies.

Many stylised facts have occurred in literature on the subject, concerning the problem of company lifetime. Some of these regularities concern the influence of characteristics specific to the company, while most describe the structural effect of the market on company survival. A basic observation, summed up by Geroski (1995), is the fact that entry into the marketplace seems relatively easy, but

surviving on it is considerably more difficult. This conclusion stems from the fact that a considerable number of firms enter the market but, at the same time, the average company lifetime is low. Another regularity, confirmed by studies (Evans 1987, Dunne, Roberts, Samuelson 1988), is the positive influence of initial company size on its lifetime. Older and larger firms possess greater resources (capital and human), and also more management experience. These firms are more immune to external shocks, have a greater market presence and influence on the market price thanks to an established brand, thanks to which their general situation is more stable. There is no agreement in the literature as to the shape of the risk function in lifetime models. It is commonly accepted that the (immediate) probability of exiting the market falls with the company's age, however, researchers have identified both monotonic (Evans 1987, Dunne, Roberts, Samuelson 1988, Audretsch, Mahmood 1995, Baldwin, Gorecki 1991, Mata, Portugal 1994, Mata, Portugal, Guimaraes 1995), as well as non-monotonic risk functions (Wagner 1994, Agarwal, Sarkar, Echambadi 2002, Cefis, Marsili 2005). The difference in the shape of the risk function is very important. Non-monotonic risk functions are consistent with standard models of industrial dynamics (Jovanovic 1982, Ericson, Pakes 1995). In these models, firms entering the market need time to "learn" to function effectively. On the other hand, the consumption of start-up capital also takes time. These facts suggest that at a particular moment, there is maximum (immediate) probability of exiting the market. The identification of this moment would be undoubtedly helpful for actions in consulting and credit policy for small and medium companies.

Research published in Poland on enterprise demographics cover the first half of the 1990's, and show a relatively highly dynamics of the processes of enterprise entry and exit to/from the manufacturing industry, especially in the initial period of the transformation (Chmiel 1997, Chmiel 1999, Orłowski, Żółkiewski 2001, Balcerowicz, Chmiel 2001). Due to methodological difficulties, primarily related to relevance and completeness of the dataset, calculation of the change rates in the population of enterprises in Poland requires many assumptions concerning the limitations of the dataset.

In Rogowski's (2005) publication, the underlying research goal was the analysis of the entry and exit processes in the enterprise sector of the Polish economy in the years 1990-2003, on the foreground of earlier national research and in the context of the observed international tendencies. The authors' conclusions are as follows: after a period of vigorous growth at the beginning of the 90's, the entry rate in the Polish manufacturing industry declined, and during the initial years of the 21st century, it is at the level of 12-14% in medium and large enterprises. International comparisons of entry rates to this sector are difficult due to differences in data gathering methodologies, size and range of the subject population. It can be noted however, that there is an unsettling tendency of a decreasing number of newly registered business entities during 2001-2003, and also the share of active entities in the analysed population is also low.

Many papers have also been written on subjects relating to enterprise bankruptcy, however, these predominately research the microeconomic causes and concern forecasting bankruptcy based on the condition of particular companies (Nowara, Szarzec 2004; Appenzeller 2004; Muszyńska, Zdunek 2007).

It is difficult to find a similar analytical approach in literature on the subject as the one presented here, however, the great importance of migration between industries has been noted. Bernard (2006) showed that, on average, 68% of American production companies change the type of products produced every five years, and as many as 47% of enterprises migrate in five year intervals. The author suggests that enterprise migration may have a greater impact on the economy's productivity than the start-up of new or the closing of existing companies.

In Poland, the main source of statistics concerning the creation and survival of companies on the market are the analyses of the Central Statistical Office[5] and the Polish Agency for Enterprise Development[6]. There is a lack, however, of analyses utilising more advanced econometric techniques that would enable a more detailed view of population dynamics.

[5] Activity of non-financial enterprises in 2008, Financial results of economic entities in 2009, Conditions of establishment, operation and development prospects of polish enterprises established in the years 2004-2008.
[6] Report on the state of small and medium enterprises 2007-2008.

3. Research methods used for demographic analysis of enterprises

A demographic analysis of enterprises can be conducted using different methods, from the simplest methods, based on the analysis of enterprise market entry/exit, through methods of descriptive statistics, to advanced stochastic models and neural networks. Based on descriptive statistics concerning the phenomenon under review, only the rate of entry and exit of enterprises on and off the market can be determined. Therefore, this method only analyses the change in population size. Other methods that may be used for a demographic analysis of the enterprise sector are:

- Logit/Probit – with the help of binary variable models, the event of a firm's exit from the market can be analysed using descriptive variables, such as: age, size, branch of industry in which the firm operates, etc. The probability of company failure is also calculated during a time horizon defined earlier (for example, a forecast of the probability of failure during the year). However, the phenomenon of migration is not accounted for.
- With the help of duration theory[7], it is possible to analyse the phenomenon under consideration in a similar way as with the logit/probit models, additionally taking censored data[8] into account. Analysis of this kind allows the estimation of the survival function, e.g. the calculation of the probability of survival after a certain time, *t*.
- Thanks to the utilisation of Markov chains, an analysis of changes in population size and distribution across different sectors of the economy can be conducted at the same time. This method allows the calculation of the distribution of companies in different sectors and to forecast the number of failed enterprises after two, three, etc. years. Markov chains are also used to forecast the distribution of economic categories, which can be presented on a by sector basis, e.g. Gross Value Added or employment. Furthermore, they are also used to calculate average age and the remaining lifetime of an enterprise in a given sector.

3.1. Markov Chains

A finite Markov Chain with a set of states $S = \{1,2,\ldots,r\}$ is called a stochastic process for which every i, j belonging to S satisfies the Markov property. This property means that the probability distribution of the state of the process at the moment in time *n*, is dependent only on the state of the process at time $n-1$, and does not depend on the earlier course of the process. This conditional probability is called the probability of the Chain passing from state i at moment $n-1$ to state j at moment n. For a homogenous Chain, the probability of changing states is independent of time[9].

The Chain states can be the sectors of the economy (at different aggregation levels) or two additional states: market entry ("Birth") and market exit ("Death"). Other possible states are: regions, forms of ownership, export volume, employment size, subsidies, possessing shares abroad and financial indicators.

The probability of changing state are stored in the form of a probability of transition matrix P.

$$P = \begin{bmatrix} p_{11} & & \cdots & p_{1n} \\ p_{21} & p_{22} & \cdots & p_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ p_{n1} & p_{n2} & \cdots & p_{nn} \end{bmatrix} \quad (1)$$

Where:

p_{12} indicates the probability of passing from state 1 to state 2;

[7] Kiefer (1988)

[8] Censored data contains information on the „lifespan" of the unit, but the exact moments of entry or exit from the analysed state are not known. Two types of censorship can be defined:

- right-sided censure of observations: occurs when the end date of the episode is unknown (then the length of time between the entry to and exit from poverty is also unknown);
- left-sided censure of observations: occurs when the beginning date of the episode was not observed (then once again the length of time in poverty is unknown).

[9] Norris (1997), Podgórska (2002)

$\sum_{j=1}^{n} p_{ij} = 1$ dla $i = 1,2,...,n;$

$0 \le p_{ij} \le 1$ dla $i, j = 1,2,...,n.$

A necessary condition of using the Markov Chain methodology is the availability of company activity type indicators for following years. Companies existing in the year $t-1$ and not existing in t have been marked as bankrupt enterprises, however non-existent in $t-1$, and existing in t as new. Companies existing in both of these periods have been marked as migrating, assuming, for simplification purposes, that migration (from state i to j) also includes remaining in the same sector/section. The Matrix that represents the demographic evolution of the population between years $t-1$ and t is given by:

$$D^{(t)} = (d_{ij}^{(t)}) = \begin{pmatrix} M^{(t)} & S^{(t)} \\ G^{T(t)} & 0 \end{pmatrix} \quad (2)$$

Within the above matrix $D^{(t)}$, the following matrices have been placed:

$M^{(t)} = (m_{ij}^{(t)})$ – matrix describing the number of crossings of enterprises between sectors i and j during $t-1$ and t,

$G^{(t)} = (g_j^{(t)})$ – vector representing the number of companies established during year t in sector j,

$S^{(t)} = (s_i^{(t)})$ – vector indicating the number of companies existing in year $t-1$ but not existing in year t in sector *i.*

A zero in matrix $D^{(t)}$ means that the given companies cannot migrate from the state “Birth” (entry to the market) to the state “Death” (exit from the market).

Properties arising from matrix $D^{(t)}$:
- the sum of elements in a single row indicates the number of enterprises in year $(t-1)$ in sector i (for $i < N$);
- the sum of elements of row $(N+1)$ indicates the number of new enterprises for the year $(t-1)$;
- the sum of elements in column j $(j < N)$ indicates the number of enterprises in year t in sector j;
- the difference in the sum of elements of the i^{th} column and the sum of i^{th} row indicate a growth/decline in the number of enterprises in sector *i*,
- the sum of elements of column $j = N+1$ indicates the number of bankrupt enterprises between year $(t-1)$ and year t;
- the diagonal elements of matrix $M^{(t)}$ indicate the number of enterprises which in the studied period remained in the same sector.

Dividing a given element of matrix $D^{(t)}$ by the sum of the elements of the row that it belongs to, we obtain the percent of enterprises formerly belonging to state i, but which emigrated to state j. In this way the transition matrix $P^{(t)}$ is created:

$$P^{(t)} = \left(p_{ij}^{(t)}\right) = \begin{pmatrix} PM^{(t)} & PS^{(t)} \\ PG^{(t)} & 0 \end{pmatrix} \quad (3)$$

Where:

$p_{ij}^{(t)} = \dfrac{d_{ij}^{(t)}}{\sum_{k=1}^{N+1} d_{ik}^{(t)}}$ - the fraction of firms migrating from state i to state j between $t-1$ and t;

$PM^{(t)}$ – describes the probability of a company's transitioning from state i to state j,

$PG^{(t)}$ – probability of a company's creation in sector/section j,

$PS^{(t)}$ – probability that a company from industry i will fall out of the market.

The next step is the transformation of the matrix $P^{(t)}$ such that it contains the same designations for rows as for columns. It is therefore necessary to add a new column made of zeros, since, according to the definition, it is impossible for a new company to transition to a different state, and a row presenting the "Death" state. According to the definition, if a company bankrupts, it does not have the possibility to pass to a different state; the state of bankruptcy is therefore an absorbing state. In this way the z $P_{ext}^{(t)}$ matrix is created (Kemeny, Snell 1960):

$$P_{ext}^{(t)} = \begin{pmatrix} PM^{(t)} & 0 & PS^{(t)} \\ PG^{(t)} & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \tag{4}$$

This matrix is a Markov Chain matrix under the condition that, the probability of passing from state i to state j is constant in time. The demography of companies will be studied using an average transition matrix over the years 2003-2008:

$$\overline{P} = \frac{1}{N}\sum_{t=1}^{N} P_{ext}^{(t)} = \begin{pmatrix} PM & 0 & PS \\ PG & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \tag{5}$$

For an absorbing Chain[10], the fundamental matrix takes on the form F:

$$F = \left(I - \begin{pmatrix} PM & 0 \\ PG & 0 \end{pmatrix} \right)^{-1} \tag{6}$$

Matrices $PM^{(t)}$ and $PG^{(t)}$ are components of the average matrix $\overline{P}$.

With the help of the fundamental matrix F, it is possible to calculate the lifetime of a company from industry i or of a newly created company. For this purpose, the elements of the selected row of matrix F should be summed up.

On the basis of an analysis of the average lifetime and age of a company, it is possible to estimate the time, after which the enterprise will cease to exist, that is, will be eliminated from the market.

Another Markov Chain takes the state of "newly created enterprise" as the absorption state. The evolution matrix of enterprises can be written as follows:

$$RD^{(t)} = (rd_{ij}^{(t)}) = \begin{pmatrix} M^{T^{(t)}} & G^{T^{(t)}} \\ S^{T^{(t)}} & 0 \end{pmatrix} = D^{T^{(t)}} \tag{7}$$

On the basis of matrix $RD^{(t)}$, a transition probability matrix will be built. Then, with the help of the fundamental matrix RF, the average number of years from the time the enterprise was created or the average age of the enterprise can be calculated for a given sector. After comparing it with the total expected lifetime, the closeness to extinction can be obtained.

Another useful property of using Markov Chains is the possibility of using a transition matrix to forecast future structure and size of the enterprise set. In order to do this, knowledge of the exact structure in the period preceding the forecasted period is necessary, hence knowledge of the so-called initial distribution:

$$A^{(0)} = \begin{pmatrix} a_1^{(0)} & a_2^{(0)} & \ldots & a_N^{(0)} & c & 0 \end{pmatrix} \tag{8}$$

[10] A Chain is said to be absorbing, if there exists absorbing state i, i.e. if a unit falls into it, it will remain there forever.

where c is the number of new firms; $a_i^{(0)}$ is the initial number of firms in branch i.

In order to forecast distributions in the coming periods, the transition probability matrix is used. The number of new enterprises c was obtained from the average evolution matrix for the studied years.

In the next period, this distribution will be given by the row vector:

$$A^{(1)} = A^{(0)} \times \overline{P} = \left(a_1^{(1)} \quad a_2^{(1)} \quad ... \quad a_N^{(1)} \quad 0 \quad s^{(1)}\right) \tag{9}$$

where $s^{(1)}$ is the number of company deaths after one year.

At the end of this section, it is worthwhile to call attention to the possibility of using the average transition matrix $\overline{P}$ to forecast the future structure and size of the enterprise set. The creation of such a matrix is, however, only justified for a long period. The economy experiences times of fast or slow economic growth, hence, for the purpose of preparing short-term forecasts, it is recommended to use the transition matrix appropriately to the expectations of the closest years. More precisely, if a period of growth is forecasted for the near future, using a transition matrix from a period of recession, or an average over the entire cycle, is without basis. In this case, two transition matrices should be utilised, one for the period of growth, and the second for decline. In such a situation, the condition concerning Markov Chains, stating that the probability of a change in state is not dependent on time, will not be met, but the future structure of the enterprise set can still be forecasted. In this case we are dealing with a Markov process (Kemeny, Snell 1960).

4. Data description

The data characterizing activities of the economic entities were collected with the use of the statistical financial report F-02[11] in the years 2003-2008. F-02 survey comprises enterprises of more than 10 employees, which keep the account books. Subject matter of the survey encompasses i.a. balance sheet, profit and loss account, expenditure for tangible fixed assets. Balance sheet items are presented as of the end of calendar year.

The data by type of principal activity of enterprises were compiled for individual the Polish Classification of Activity PKD sections (PKD 2004 – Nace Rev. 1.1). As regards the binding classification sections, the term Industry was introduced, including the following sections: Mining and quarrying, Manufacturing and electricity, gas and water supply, as an additional grouping and the term Other service activities was introduced, including the following sections: Hotels and restaurants, Financial intermediation, Real estate, renting and business, Education, Health and social work, Other community, social and personal service activities. The surveyed group was also divided into small, medium, and large enterprises. In accordance with the binding definitions, the first of these groups covered entities with up to 49 persons employed (within which the micro-entities with up to 9 persons employed were recognised as a separate group), the second one covered entities with 50 – 249 persons employed, while entities with more than 249 persons employed were classified to the third group. A separation was also performed between the private and public sectors. Additionally, a separation was made as to the export volume[12] (non-exporter, unspecialised exporter – an entity that is in business regardless of the level of export, specialised exporters – entity whose revenue is over 50% dependent on exports).

The development process of the enterprise population in a sector has been analysed using the following guidelines, defined on the basis of European Commission guidelines from 2007:

- Active enterprise:

[11] The following organisation units: commercial companies (partnerships and capital companies), civil law partnerships, state-owned enterprises, cooperatives, branches of foreign companies and single proprietors, of more than 10 employees, which keep account books and their activities are classified under sections A-K and M-O of the Statistical Classification of Economic Activities (excluding section M, group 80.3, insurance companies, banks, brokers, investment funds, investment funds corporations, pension funds and individual farmers).

[12] Marczewski (2007)

- realising sales and/or
- employing at least one person in the span of a year.

- A new enterprise: exists in year t, but did not exist in year $t-1$, with the exception of companies that:
  - were created by the merger of existing enterprises,
  - were created by the breakup of an existing enterprise
  - changed their identification number.
- A death enterprise: existed in $t-1$, and does not exist in year t, with the exception of companies which:
  - ceased to exist do to mergers and takeovers,
  - ceased to exist due to a breakup of an existing enterprise,
  - changed their identification number.

Basic information regarding the sample of enterprises used in this study is contained in Table 1 which sums up the entire number of active enterprises, number of new and bankrupt enterprises and the balance (growth or decline) of the number of enterprises during the analysis period. The dynamics indicator for the number of new entities can be treated as a barometer of the state of the economic cycle. New companies entering the market push out ineffective businesses on the one hand, and one the other, force changes in innovation and growth on the remaining ones, which is necessary to preserve competitive advantage. Relations between enterprises influence the competitiveness and effectiveness of the entire economy. It is therefore worthwhile to note, that during the following years of 2003-2008, at a time of economic boom, the percentage of new enterprises varied from around 17% of the number of active enterprises in 2003, to 13% in 2007. 2008 was an exception, when the percent of new enterprises in the total group was as high as 21%. At the same time, it can be supposed that this is partly due to an acceleration in the implementation of aid programs aimed at starting and carrying on business. However, the percentage of bankrupt enterprises in the total population varied from 13% in 2003, to 12% in 2008. In 2004, the indicator of the balance of the number of enterprises in comparison with the number of functioning enterprises was negative, amounting to -2.7%. Among causes that could have contributed to the occurrence of this phenomenon is the strong growth of inflation observed during the period near accession, primarily resulting from the growth of resource and material prices. It is worthwhile to note that a visible decline in investment activity occurred in this year, which was partly caused by the appreciation of the PLN, the psychological effect related to the effects of the August interest rate increase, or the observed inventory growth, which is negatively correlated with willingness to undertake investment activity[13]. At the same time, the massive wave of emigration following Poland's entrance to the EU should be mentioned, which was, to a certain degree, an export of unemployment.

Table 1. Basic information concerning enterprise creation and bankruptcy in the years 2003-2008

	2003	**2004**	**2005**	**2006**	**2007**	**2008**
Number of active enterprises	**45 742**	**44 541**	**46 396**	**47 048**	**48 165**	**53 148**
Births	**7630**	**5 573**	**7 032**	**6 426**	**6 429**	**11 579**
p.c. of births compares with active enterprises	16,68%	12,51%	15,16%	13,66%	13,35%	21,79%
Deaths	**5952**	**6 774**	**5 177**	**5 774**	**5 312**	**6 596**
p.c. of deaths compared with active enterprises	13,01%	15,21%	11,16%	12,27%	11,03%	12,41%
Growth	1678	-1 201	1 855	652	1 117	4 983
p.c. growth compared with active enterprises	3,67%	-2,70%	4,00%	1,39%	2,32%	9,38%

Source: Own calculations

[13] A report of the National Bank of Poland (2004)

5. Results

5.1. The demographic evolution matrix

On the basis of the methodology presented in section 3, the evolution matrix $D^{(t)}$ has been calculated for the following years: 2003-2004, 2004-2005, 2005-2006, 2006-2007and 2007-2008, according to the type of business activity divided into 6 or 13 sections and sectors. A large majority of enterprises did not change their activities in the course of the following two years. In the time span of the entire study period, migrations between sectors have been noted, which allowed them to maintain or strengthen their position on the market.

The most impacted were units previously associated with transport (see table 1a in the Appendix). These enterprises mainly undertook trade, and also a range of other services. The majority of units remaining in the same sector/section, during 2007-2008, carried on business related to industry and trade. A relatively common transition was between the sectors "Industry" and "Trade". However, by looking at the probability of transitioning from table 2a, it can be seen that migration between different sections and sectors was principally not very probable. The most important outflows and inflows to sectors/section arose mainly due to commencing and ending of business by enterprises. It is also worthwhile to note that the most new companies were created in the trade section, and that it is in that section, that the highest number also ended their activity. This conclusion is also partly transposed on the observed probability – the most probable sector/section for starting a new enterprise is, precisely, the trade section. Between sectors, where there is an absence of barriers to entry and exit, capital flows freely, leading to an equalisation of return rates. In sectors with strong entry barriers, the rates of return are higher than average, however in sectors with high exit barriers, the rates of return are lower than average. Economic barriers to entry are: absolute cost advantage, returns to scale and differentiated product. Also, enterprises entrenched in a sector can create different types of strategic entry barriers. Legal barriers entail the necessity of obtaining permits and concessions to produce a given product. Technical entry barriers are related to the availability of technology, patent protection and technical progress. However, exit barriers out of a sector take on various forms. Economic exit barriers arise out of the fact, that fixed assets are highly specialised in well-developed sectors. Legal exit barriers arise out of government regulations. Strategic exit barriers may be related to the capital market.

In all the sectors/sections, the probability of company bankruptcy are similar to each other and amount to from 11% to 15%. "Agriculture, fishing, etc." can be regarded as the least dynamic sector – in this sector, the fewest new companies have been created, and the fewest companies have gone bankrupt. This sector is also the least likely place to start a new business.

Table 2a. Enterprise migration matrices between 2007-2008 by principal activity (six sections) in %

Kind of activity		**1**	**2**	**3**	**4**	**5**	**6**	**Death**
Agriculture, forestry, hunting and fishery	(1)	**86,45%**	0,59%	0,39%	0,59%	0,07%	0,13%	11,78%
Industry	(2)	0,02%	**86,13%**	0,24%	0,53%	0,05%	0,31%	12,71%
Construction	(3)	0,02%	0,47%	**85,70%**	0,27%	0,07%	0,76%	12,71%
Trade	(4)	0,03%	0,59%	0,15%	**84,07%**	0,12%	0,32%	14,71%
Transportation and storage and communication	(5)	0,00%	0,32%	0,44%	0,80%	**81,87%**	0,64%	15,92%
Other sernice activities	(6)	0,02%	0,37%	0,20%	0,26%	0,05%	**85,03%**	14,08%
Birth		1,23%	22,53%	13,98%	32,48%	6,99%	22,79%	

Source: Own calculations

Table 2b. Enterprise migration matrices between 2007-2008 by principal activity (13 sections) in %

Kind of activity		1	2	3	4	5	6	7	8	9	10	11	12	13	Death
Agriculture, forestry, hunting and fishery	(1)	**86,45 %**	0,00%	0,52%	0,07%	0,39%	0,59%	0,07%	0,07%	0,00%	0,07%	0,00%	0,00%	0,00%	11,78%
Industry:															
- Miting and quarrying	(2)	0,00%	**86,64%**	0,86%	0,00%	0,86%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	11,64%
- Manufacturing	(3)	0,02%	0,02%	**85,58%**	0,01%	0,21%	0,57%	0,05%	0,00%	0,01%	0,19%	0,01%	0,00%	0,02%	13,31%
- Electricity, gas and water supply	(4)	0,00%	0,00%	0,00%	**94,47%**	0,54%	0,00%	0,11%	0,00%	0,00%	0,22%	0,00%	0,00%	1,63%	3,04%
Construction	(5)	0,02%	0,00%	0,45%	0,02%	**85,70%**	0,27%	0,07%	0,02%	0,02%	0,70%	0,00%	0,00%	0,02%	12,71%
Trade	(6)	0,03%	0,00%	0,57%	0,02%	0,15%	**84,07%**	0,12%	0,02%	0,02%	0,27%	0,00%	0,01%	0,00%	14,71%
Transportation and storage and communication	(7)	0,00%	0,00%	0,32%	0,00%	0,44%	0,80%	**81,87%**	0,04%	0,00%	0,44%	0,00%	0,00%	0,16%	15,92%
Other sernice activities:															
- Hotels and restaurants	(8)	0,00%	0,00%	0,00%	0,00%	0,00%	0,71%	0,00%	**77,25%**	0,24%	0,24%	0,00%	0,12%	0,00%	21,45%
- Financial intermediation	(9)	0,00%	0,00%	0,65%	0,00%	0,32%	0,65%	0,00%	0,00%	**75,40%**	0,65%	0,00%	0,00%	0,00%	22,33%
- Real estate, renting & siness	(10)	0,02%	0,02%	0,28%	0,02%	0,26%	0,24%	0,07%	0,07%	0,04%	**86,16%**	0,02%	0,04%	0,07%	12,68%
- Education	(11)	0,00%	0,00%	0,00%	0,00%	0,00%	0,50%	0,00%	0,00%	0,00%	1,49%	**71,29%**	0,00%	0,00%	26,73%
- Heath and social work	(12)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,09%	0,00%	0,09%	0,00%	**86,09%**	0,00%	13,72%
- Other community, social and personal service activities	(13)	0,11%	0,11%	0,00%	1,28%	0,21%	0,11%	0,00%	0,11%	0,00%	0,96%	0,00%	0,00%	**86,77%**	10,35%
Birth		1,23%	0,38%	21,65%	0,50%	13,98%	32,48%	6,99%	2,32%	1,20%	14,95%	0,87%	1,77%	1,68%	

Source: Own calculations

Table 1b of the Appendix includes quantitative results separated into 13 sections and sectors, while table 2b contains the probabilities of transitioning, again separated into 13 sections and sectors. On the basis of table 3b of the Appendix, it can be concluded that the main driving force of the changes in the industrial sector is manufacturing. The highest number of transitions took place between the trade section and the manufacturing section (flow in both direction) and between the manufacturing section and construction, although comparing the quantitative results again with the probabilities received it can be concluded, that the transfer of sections has a relatively low probability. Worth noting is the fact that the mining and quarrying section is characterised by the lowest number of newly created and bankrupt enterprises. It can also be considered, that the probability of bankruptcy and new company creation are more varied in the case of separating the firms into 13 sectors and section than in the case of 6 sectors and section – in the former division method, the probability of bankruptcy ranges from 3.04% ("Electricity, gas and hydro production and supply" section) to 26% ("Education" section), while the probability of company creation in a given sector ranges from 0.38% ("Mining and quarrying" section) to 32.48% ("Trade" section), which speaks in favour of conducting an analysis at the higher point of disaggregation.

Results for all six sectors and sections, connected with the trade type, company size and forms of ownership are presented in tables 1c-1e of the Appendix, the probability of transitioning are in tables 2c-2e. On the basis of the results presented, it can be noted that migrations between sections/sectors occur in both directions – this concerns migration between construction, industry, trade and the remaining services. Once again, however, on the basis of the probability matrix, it can be stated that the probability of changing sectors is usually close to 0.

Analysing enterprise migration in the context of trade type (*non-exporter*, *exporter non-specialized, exporter specialized*), it is worthwhile to refer to existing literature, which systematises the issues related to the selection of trade type by enterprises. As noted by Puchalska (2010), for many enterprises, the beginning of export activity is not accompanied by serious investments supporting their growth – entry to the foreign market does not therefore necessitate the investment of considerable funds by the exporter. Low investment requirements may, however, be one reason why a portion of exporters do not realise clear profits – upon entering the foreign market, many enterprises did not note any real improvement in their economic indicators. For a portion of exporters, entry to the foreign market does not, in principle, serve expansion, but rather gaining an additional source of income[14]. Nevertheless, expansion may of course be the reason why companies choose to direct their trade abroad; among other causes, the possibility of locating excess product on the new market due to decreasing demand in the home market should be mentioned, as well as the implementation of a decision of a parent company or capital group, or a diversification of the consumer market.

The underlying benefit for an enterprise from a presence in foreign markets is sales growth, however, there are other related issues such as high efficiency, higher profitability of sales and more advanced production technology. There are many articles in the literature, whose authors analyse the causes of these benefits (Bernard, Jensen 1995; 1999; Bernard et al. 2007; Clerides, Lach, Tybout 1996; Kneller, Pisu 2007; Fryges, Wagner 2008). In the first trend of studies (focusing on the *self-selection* hypothesis), it is accepted that foreign trade is selected by stronger companies, while weaker and less effective ones decide to limit their activity to the national market, due to higher costs of commencing activities abroad. The second research trend (based on the *learning-by-exporting* hypothesis), the authors assume the approach that activity on foreign markets, thanks to the transfer of technology and know-how, together with effects of scale, stimulates the development of export companies.

To conclude this short theoretical digression, it is worthwhile to note that a very important factor stimulating export is the inflow of foreign capital, as it contributes to the modernisation of the economy, thanks to new technologies and the transfer of knowledge, and also allows to fill in shortages with regards to capital accumulation, impacting simultaneously on the effectiveness, scale and effectiveness of investments.

[14] Puchalska (2010)

Table 2c. Enterprise migration matrices between 2007-2008 by principal activity (six sections) and by export volume in %

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Death
Agriculture, forestry, hunting and fishery																				
- *non-exporter*	(1)	**84,18%**	**2,31%**	**0,07%**	0,45%	0,00%	0,00%	0,37%	0,00%	0,00%	0,45%	0,00%	0,00%	0,07%	0,00%	0,00%	0,00%	0,00%	0,00%	12,09%
- *exporter non-specialized*	(2)	**21,90%**	**63,50%**	**5,11%**	0,00%	1,46%	0,00%	0,00%	0,00%	0,00%	1,46%	0,00%	0,00%	0,00%	0,00%	0,00%	0,73%	0,00%	0,00%	5,84%
- *exporter specialized*	(3)	**7,84%**	**5,88%**	**58,82%**	1,96%	0,00%	0,00%	0,00%	0,00%	1,96%	0,00%	1,96%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	1,96%	19,61%
Industry																				
- *non-exporter*	(4)	0,00%	0,00%	0,00%	**71,69%**	**8,86%**	**1,75%**	0,40%	0,00%	0,01%	0,47%	0,05%	0,00%	0,10%	0,00%	0,00%	0,45%	0,03%	0,00%	16,17%
- *exporter non-specialized*	(5)	0,02%	0,03%	0,00%	**14,25%**	**72,44%**	**3,16%**	0,05%	0,08%	0,00%	0,19%	0,47%	0,07%	0,00%	0,00%	0,00%	0,10%	0,10%	0,00%	9,04%
- *exporter specialized*	(6)	0,00%	0,00%	0,00%	**6,19%**	**8,81%**	**73,73%**	0,00%	0,00%	0,00%	0,03%	0,00%	0,10%	0,00%	0,00%	0,03%	0,00%	0,00%	0,10%	10,99%
Construction																				
- *non-exporter*	(7)	0,03%	0,00%	0,00%	0,35%	0,05%	0,00%	**83,48%**	**1,68%**	**0,55%**	0,18%	0,00%	0,03%	0,08%	0,00%	0,00%	0,68%	0,03%	0,00%	12,87%
- *exporter non-specialized*	(8)	0,00%	0,00%	0,00%	0,30%	0,60%	0,00%	**31,33%**	**58,43%**	**1,51%**	0,30%	0,60%	0,00%	0,00%	0,00%	0,00%	0,60%	1,20%	0,00%	5,12%
- *exporter specialized*	(9)	0,00%	0,00%	0,00%	0,00%	0,00%	1,46%	**9,49%**	**9,49%**	**52,55%**	0,00%	0,73%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	26,28%
Trade																				
- *non-exporter*	(10)	0,03%	0,00%	0,00%	0,36%	0,05%	0,01%	0,16%	0,01%	0,00%	**77,59%**	**4,70%**	**0,20%**	0,09%	0,01%	0,01%	0,33%	0,01%	0,00%	16,44%
- *exporter non-specialized*	(11)	0,00%	0,03%	0,00%	0,13%	0,86%	0,06%	0,03%	0,06%	0,00%	**21,18%**	**68,06%**	**0,73%**	0,03%	0,06%	0,00%	0,10%	0,16%	0,00%	8,50%
- *exporter specialized*	(12)	0,00%	0,00%	0,00%	0,36%	0,00%	1,80%	0,00%	0,00%	0,00%	**8,27%**	**13,67%**	**58,99%**	0,00%	0,36%	0,72%	0,00%	0,00%	0,00%	15,83%
Transportation and storage and communication																				
- *non-exporter*	(13)	0,00%	0,00%	0,00%	0,30%	0,06%	0,00%	0,67%	0,00%	0,00%	0,85%	0,00%	0,00%	**71,07%**	**5,81%**	**2,72%**	0,79%	0,00%	0,00%	17,74%
- *exporter non-specialized*	(14)	0,00%	0,00%	0,00%	0,00%	0,19%	0,00%	0,00%	0,00%	0,00%	0,19%	0,77%	0,00%	**21,92%**	**60,38%**	**6,35%**	0,38%	0,00%	0,00%	9,81%
- *exporter specialized*	(15)	0,00%	0,00%	0,00%	0,00%	0,32%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,32%	**14,87%**	**7,91%**	**59,81%**	0,00%	0,32%	0,00%	16,46%
Other sernice activities																				
- *non-exporter*	(16)	0,03%	0,00%	0,00%	0,27%	0,01%	0,01%	0,17%	0,01%	0,00%	0,22%	0,00%	0,00%	0,04%	0,00%	0,00%	**82,34%**	**2,15%**	**0,30%**	14,44%
- *exporter non-specialized*	(17)	0,00%	0,00%	0,00%	0,14%	0,81%	0,00%	0,00%	0,14%	0,00%	0,14%	0,54%	0,00%	0,00%	0,00%	0,00%	**22,12%**	**63,36%**	**2,17%**	10,58%
- *exporter specialized*	(18)	0,00%	0,00%	0,00%	0,00%	0,35%	0,35%	0,70%	0,00%	0,00%	0,00%	0,00%	0,35%	0,00%	0,00%	0,35%	**8,04%**	**8,39%**	**68,18%**	13,29%
Birth		1,06%	0,09%	0,08%	15,80%	4,08%	2,64%	13,28%	0,40%	0,30%	27,78%	4,02%	0,67%	5,59%	0,71%	0,69%	20,49%	1,39%	0,91%	

Source: Own calculations

Analysing study results regarding inter-sector migration based on trade type, contained in tables 1c of the Appendix and 2c, it should be noted that 2008 was a not uniform due to the onset of the crisis on world financial markets – it can be separated into a period of before and after the crisis explosion, i.e., up to and after September 2008. Prior to September 2008, a gradual slowdown of the economy was observed, while for exporters, the decline in growth dynamics was stronger than for enterprises functioning exclusively on the national market, which was related to the strong PLN, lowering the profitability of export sales, and to the slowdown in the economies of our foreign trade partners. Companies offering their products exclusively in the country felt the problems with a delay and on a lower scale.

On the basis of table 2c, it can be noted that non-exporters comprise the most numerous group in every section/sector. Despite the development of foreign trade, Poland remains a country with a low relation of export to GDP, and a low level of export per capita. However, on the basis of results presented in table 3c, it was concluded that the most common transfer in all sectors is migration from the group of non-specialised exporters to the group of non-exporters – the probabilities of such transitions range from 14% to 31%, while the probability of transitions in the opposite direction are from around 2% to 8%. Correspondingly, transitions from the group of specialised exporters to non-exporters are more probable than transitions in the opposite direction, however the probability of changing the mode of trade are considerably lower in this case. According to expectations, the probability of creating new non-export companies is considerably higher than the probability that a new company will engage in any form of export – this conclusion concerns practically all sectors and sections. The economic crisis has made itself felt in a fall of the demand for goods exported from Poland (on the basis of data from the Central Statistical Office, the volume of export fell in 2009 by 9.3%), as a result, it was more difficult for small and medium entities to undertake export activities.

An important conclusion from table 1c of the Appendix and 2c, is the fact that specialised export firms appear to be endangered at a comparable or even slightly higher rate to bankruptcy than non-export companies – for example, in the case of the construction section, the probability of bankruptcy for those in specialised export amounts to as much as 26%, while in the case of non-export companies, it is 12%. In the case of non-specialised exporters, the probability of bankruptcy is usually slightly lower than for the remaining companies. For a large majority of exporters in the population, including manufacturing, the main source of revenue still remains home country sales.

On the basis of table 2d, containing the probabilities of transitioning depending on company size, it can be concluded that in practically all sectors, the position of larger companies is more stable, that is, larger companies have a higher probability of remaining in a given category in the following period than smaller companies. For the majority of sectors/sections, large and medium companies have a small tendency to reduce employment, that is, the probability that a large company will transition to the group of medium companies and that a medium-sized company will transit to the group of small enterprises are generally higher than transitions in the opposite direction. The largest differences in the aforementioned probabilities occur in the "Construction" section. It should be added, however, that in the case of all companies, except the smallest ones, changes in the employment level are decidedly less probable than the maintenance of the current level of employment in the company. It is worthwhile to have a closer look at micro-companies[15]. What is interesting is that in their case, the most likely transition is to end economic activity – this probability ranges between sectors from 72% ("Agriculture, fishing, etc.") to 95% ("Transport, storage and communications"). It should also be mentioned, that in the case of micro-companies, the probability that a company will transition to the category of small companies is higher than the probability of transitioning in the opposite direction, although naturally both of these probabilities are considerably lower than the probability of bankruptcy. To summarise, it can be said that the probabilities of company's bankruptcy in almost all the sectors decrease with the growth in company size – as reaffirmed by the conclusion on the more stable situation of larger companies. However, the most new companies were created in the category of small entities, which is consistent with the results of Klapser (2004), conducted for Central and Eastern European countries, stating that an entry company is small in terms of employment.

[15] In the F-02 data set, only those micro-companies are observed that were previously classified as small companies and subsequently reduced employment. This is around 3% of micro-companies using full accounting in Poland.

Table 2d. Enterprise migration matrices between 2007-2008 by principal activity (six sections) and by size class in %

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Dearth
Agriculture, forestry, hunting and fishery																									
- *micro* (1)	**14,85%**	**11,88%**	**0,00%**	**0,00%**	0,00%	0,99%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	72,28%
- *small* (2)	**3,72%**	**85,88%**	**0,59%**	**0,00%**	0,00%	0,42%	0,00%	0,00%	0,00%	0,34%	0,17%	0,00%	0,00%	0,68%	0,00%	0,00%	0,00%	0,08%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	8,11%
- *medium* (3)	**0,00%**	**10,05%**	**82,65%**	**0,46%**	0,00%	0,91%	0,46%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,46%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,91%	0,00%	4,11%
- *large* (4)	**0,00%**	**4,00%**	**4,00%**	**84,00%**	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	8,00%
Industry																									
- *micro* (5)	0,00%	0,00%	0,00%	0,00%	**1,77%**	**6,36%**	**0,35%**	**0,00%**	0,00%	0,00%	0,00%	0,00%	0,35%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	91,17%
- *small* (6)	0,00%	0,00%	0,00%	0,00%	**1,41%**	**77,25%**	**3,73%**	**0,03%**	0,00%	0,30%	0,01%	0,00%	0,04%	0,65%	0,03%	0,00%	0,01%	0,08%	0,00%	0,00%	0,00%	0,36%	0,01%	0,00%	16,10%
- *medium* (7)	0,00%	0,01%	0,03%	0,00%	**0,14%**	**5,60%**	**83,09%**	**1,64%**	0,00%	0,00%	0,23%	0,00%	0,00%	0,06%	0,36%	0,00%	0,00%	0,00%	0,03%	0,00%	0,00%	0,03%	0,23%	0,00%	8,55%
- *large* (8)	0,00%	0,00%	0,00%	0,00%	**0,33%**	**0,16%**	**8,90%**	**87,35%**	0,05%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,22%	0,00%	0,00%	0,00%	0,00%	0,00%	0,05%	0,11%	0,16%	2,66%
Construction																									
- *micro* (9)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	**4,48%**	**5,97%**	**0,00%**	**0,00%**	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	89,55%
- *small* (10)	0,00%	0,04%	0,00%	0,00%	0,04%	0,42%	0,04%	0,00%	**1,74%**	**78,56%**	**4,89%**	**0,04%**	0,00%	0,34%	0,00%	0,00%	0,00%	0,04%	0,04%	0,00%	0,00%	0,87%	0,00%	0,00%	12,95%
- *medium* (11)	0,00%	0,00%	0,00%	0,00%	0,00%	0,07%	0,40%	0,00%	**0,34%**	**6,78%**	**84,28%**	**0,67%**	0,00%	0,00%	0,13%	0,00%	0,00%	0,00%	0,07%	0,00%	0,00%	0,13%	0,40%	0,00%	6,72%
- *large* (12)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,54%	**0,54%**	**1,09%**	**9,78%**	**84,24%**	0,00%	0,00%	0,00%	0,54%	0,00%	0,00%	0,00%	0,00%	0,00%	0,54%	0,54%	0,54%	1,63%
Trade																									
- *micro* (13)	0,00%	0,00%	0,00%	0,00%	0,00%	0,19%	0,19%	0,00%	0,00%	0,00%	0,00%	0,00%	**5,21%**	**7,82%**	**0,00%**	**0,00%**	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	86,59%
- *small* (14)	0,01%	0,03%	0,00%	0,00%	0,03%	0,37%	0,03%	0,00%	0,00%	0,17%	0,01%	0,00%	**1,76%**	**81,03%**	**2,60%**	**0,00%**	0,02%	0,05%	0,00%	0,00%	0,01%	0,31%	0,01%	0,00%	13,57%
- *medium* (15)	0,00%	0,00%	0,00%	0,00%	0,00%	0,17%	0,80%	0,20%	0,00%	0,00%	0,07%	0,00%	**0,33%**	**5,54%**	**83,27%**	**1,60%**	0,00%	0,03%	0,33%	0,00%	0,00%	0,07%	0,20%	0,03%	7,35%
- *large* (16)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,93%	0,00%	0,00%	0,00%	0,23%	**1,17%**	**0,23%**	**4,43%**	**88,34%**	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,23%	0,23%	4,20%
Transportation and storage and communication																									
- *micro* (17)	0,00%	0,00%	0,00%	0,00%	0,00%	1,35%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	**0,00%**	**2,70%**	**0,00%**	**0,00%**	0,00%	0,00%	0,00%	0,00%	95,95%
- *small* (18)	0,00%	0,00%	0,00%	0,00%	0,00%	0,27%	0,00%	0,00%	0,07%	0,48%	0,00%	0,00%	0,00%	0,95%	0,00%	0,00%	**2,79%**	**74,51%**	**2,45%**	**0,07%**	0,00%	0,55%	0,27%	0,00%	17,59%
- *medium* (19)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,28%	0,00%	0,00%	0,00%	0,41%	0,00%	0,00%	0,00%	0,69%	0,00%	**0,55%**	**5,79%**	**81,24%**	**2,07%**	0,00%	0,14%	0,14%	0,00%	8,69%
- *large* (20)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,45%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,45%	**0,90%**	**0,00%**	**1,80%**	**93,69%**	0,00%	0,00%	0,00%	0,90%	1,80%
Other sernice activities																									
- *micro* (21)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	**5,54%**	**5,77%**	**0,23%**	**0,00%**	88,45%
- *small* (22)	0,00%	0,02%	0,00%	0,00%	0,00%	0,28%	0,02%	0,02%	0,02%	0,26%	0,00%	0,00%	0,02%	0,32%	0,02%	0,00%	0,00%	0,04%	0,00%	0,00%	**2,31%**	**80,75%**	**2,81%**	**0,00%**	13,11%
- *medium* (23)	0,00%	0,00%	0,04%	0,00%	0,00%	0,04%	0,47%	0,04%	0,00%	0,00%	0,08%	0,00%	0,00%	0,04%	0,13%	0,00%	0,00%	0,00%	0,08%	0,00%	**0,13%**	**4,71%**	**86,82%**	**1,95%**	5,47%
- *large* (24)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,35%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	**0,00%**	**0,52%**	**6,97%**	**89,90%**	2,26%
Birth	0,31%	0,85%	0,07%	0,00%	2,47%	15,61%	4,01%	0,44%	1,79%	10,86%	1,31%	0,03%	4,77%	25,47%	2,10%	0,15%	0,79%	5,31%	0,82%	0,06%	5,26%	14,87%	2,28%	0,38%	

Source: Own calculations

Table 2e. Enterprise migration matrices between 2007-2008 by principal activity (six sections) and by form of ownership in %

		1	2	3	4	5	6	7	8	9	10	11	12	Death
Agriculture, forestry, hunting and fishery														
- *public sector*	(1)	**92,11%**	**0,88%**	0,88%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,88%	0,00%	5,26%
- *private sector*	(2)	**0,07%**	**85,86%**	0,00%	0,57%	0,00%	0,42%	0,00%	0,64%	0,00%	0,07%	0,00%	0,07%	12,31%
Industry														
- *public sector*	(3)	0,00%	0,00%	**89,00%**	**3,72%**	0,08%	0,00%	0,00%	0,08%	0,00%	0,00%	1,49%	0,00%	5,62%
- *private sector*	(4)	0,00%	0,02%	**0,05%**	**85,57%**	0,01%	0,25%	0,00%	0,56%	0,00%	0,06%	0,00%	0,22%	13,27%
Construction														
- *public sector*	(5)	0,00%	0,00%	0,72%	0,00%	**84,78%**	**3,62%**	0,00%	0,00%	0,00%	0,00%	2,17%	0,00%	8,70%
- *private sector*	(6)	0,00%	0,02%	0,00%	0,46%	**0,02%**	**85,59%**	0,00%	0,28%	0,00%	0,07%	0,00%	0,72%	12,83%
Trade														
- *public sector*	(7)	0,00%	0,00%	2,38%	0,79%	0,00%	0,00%	**80,95%**	**3,97%**	0,00%	0,00%	0,79%	0,00%	11,11%
- *private sector*	(8)	0,00%	0,03%	0,00%	0,57%	0,00%	0,15%	**0,01%**	**84,06%**	0,00%	0,13%	0,00%	0,31%	14,74%
Transportation and storage and communication														
- *public sector*	(9)	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,33%	0,00%	**91,80%**	**2,62%**	0,66%	0,00%	4,59%
- *private sector*	(10)	0,00%	0,00%	0,00%	0,37%	0,00%	0,50%	0,00%	0,87%	**0,00%**	**80,11%**	0,00%	0,64%	17,51%
Other sernice activities														
- *public sector*	(11)	0,00%	0,00%	1,28%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	**90,56%**	**1,19%**	6,97%
- *private sector*	(12)	0,00%	0,03%	0,00%	0,24%	0,00%	0,22%	0,00%	0,30%	0,00%	0,05%	**0,05%**	**84,00%**	15,11%
Birth		0,03%	1,19%	0,50%	22,03%	0,14%	13,85%	0,04%	32,44%	0,11%	6,88%	0,80%	21,98%	

Source: Own calculations

According to the Polish Confederation of Private Employers Lewiatan, the principal barriers for the development of small and medium enterprises in Poland include capital limitations and an unnecessarily difficult access to external sources of financing. High interest rates on loans as well as provisions and bank fees, required securities and also the level of the formalisation of bank process, cause that many economic entities finance growth exclusively from their own capital. According to a research by the Polish Agency for Enterprise Development, 70% of small and medium enterprises financed themselves exclusively from their own funds in 2008, and 9.8% had obligations at a level not exceeding 10% of the value of their assets.

In the context of the ownership form of enterprises, it is commonly considered that private enterprises are characterised by higher effectiveness in a market economy, than public enterprises. This is accompanied by the belief that it is the change in the form of ownership during the ownership restructuring process that allows for the activation of factors leading to the growth of enterprise effectiveness[16].

Public-sector enterprises are frequently characterised by low work efficiency and profitability, high cost level indicators and incur financial looses. Increasing the effectiveness of the enterprise operations is considered as the main goal in privatisation.

On the basis of the transition matrix, segregated according to the form of ownership, presented in tables 1e of the Appendix and 2e it can be concluded that migrations between sectors mainly concern private companies; the exception are migrations in the public sectors between the remaining services, industry and construction. The majority of government-owned firms is active in the industrial sector and other services. On the basis of Chyczewski (2007), in the years 2006-2007, the industrial production of the public sector practically did not change, despite an economic boom. In accordance with expectations, the public sector turned out to be more stable – the probability of bankruptcy of public companies in almost all sectors, is considerably lower than that of private companies, and the probability that a newly created company will be public is very close to 0 in all sectors. To conclude, it is worthwhile to note that for all sections/sectors during 2008, a slightly higher transitions of public companies to the private sector was observed, compared to the years 2006-2007, the strongest was in industry, construction and trade (the probability of such transitions in the these sectors is around 4%). Despite a livening in 2008, privatisation processes are still slower, compared to plans and expectations. Additionally, the sudden breakdown on the world financial markets, in the second half of 2008, contributed to a considerable worsening of the conditions for carrying on privatisation, and in consequence, delays or temporary postponements of certain privatisation processes.[17]

One of the effects of the financial crisis is a considerable limitation of access to financing investments through potential strategic investors. Enterprises and financial institutions financing growth with the help of short-term loans have found themselves in particularly unfavourable circumstances – its refinancing is frequently not possible, and the only reason to get out of this situation is a sudden limit of investments and a frequently deep and quick restructuring.

5.2. Demographic evolution of Polish enterprises between 2007-2008

On the basis of table 3, it has been observed that between 2007 and 2008, the net enterprise population grew by 10.4%, however 13.7% active companies went bankrupt. New enterprises comprised approx. 24% of the population from 2007. Percent wise, the highest number of new companies were created in the "Construction" sector (36.4%); around 2.2% transitioned to this group from other sections, and 1.6% of it emigrated. The number of construction companies is on the rise, which is related to the continuing rate of economic growth and the demand for housing. At the same time, demand for construction services is strengthened by the inflow of financial means from European Union structural funds, which are partly intended for construction investments. 12.7% of enterprises engaged in the construction business bankrupted between 2007 and 2008. The only sector, in which a decline in the number of enterprises occurred between 2007 and 2008 is the "Agriculture, fishing, etc." sector. The most dynamic sectors are "Education" and "Financial agency services" – these sectors have a relatively high percentage of newly formed companies (50% and 45%,

[16] Szewc-Rogalska (2004)

[17] Ministry of Treasury (2009), „The assessment of the course of privatisation of state-owned assets in 2008"

respectively); also, a relatively high number of firms bankrupted in both of these sectors (26% and 22%, respectively).

On average, the percentage of new enterprises ranged from 9% to 36% of the 2007 enterprise population, however the percentage of enterprises migrating to a given section varied from 0.4% to 3.2% of the population in 2007. Between 10% to 16% of all active enterprises fell out of the population between 2008 and 2007, and from 0.2% to 2.2% enterprises migrated to other sections.

Table 3. Demographic evolution of enterprises between 2007-2008

a) Changes 2007-2008

Kind of activity		**2007**	**Birth**	**Migrate-in**	**Migrate-out**	**Death**	**2008**
Agriculture, forestry, hunting and fishery	(1)	1528	142	10	27	180	1473
Industry	(2)	16508	2609	156	191	2098	16984
Construction	(3)	4447	1619	96	71	565	5526
Trade	(4)	14498	3761	151	176	2133	16101
Transportation and storage and communication	(5)	2488	809	35	55	396	2881
Other sernice activities:		8696	2639	185	113	1224	10183
- Hotels and restaurants	(6)	844	269	12	11	181	933
- Financial intermediation	(7)	309	139	10	7	69	382
- Real estate, renting & business	(8)	5347	1731	130	62	678	6468
- Education	(9)	202	101	2	4	54	247
- Health and social work	(10)	1057	205	4	2	145	1119
- Other community, social and personal service activities	(11)	937	194	27	27	97	1034
Total		**48165**	**11579**	**-**	**-**	**6596**	**53148**

b) Percentages 2007

Kind of activity		**2007**	**Birth**	**Migrate-in**	**Migrate-out**	**Death**	**2008**
Agriculture, forestry, hunting and fishery	(1)	100%	9,29%	0,65%	1,77%	11,78%	96,40%
Industry	(2)	100%	15,80%	0,94%	1,16%	12,71%	102,88%
Construction	(3)	100%	36,41%	2,16%	1,60%	12,71%	124,26%
Trade	(4)	100%	25,94%	1,04%	1,21%	14,71%	111,06%
Transportation and storage and communication	(5)	100%	32,52%	1,41%	2,21%	15,92%	115,80%
Other sernice activities:		100%	30,35%	2,13%	1,30%	14,08%	117,10%
- Hotels and restaurants	(6)	100%	31,87%	1,42%	1,30%	21,45%	110,55%
- Financial intermediation	(7)	100%	44,98%	3,24%	2,27%	22,33%	123,62%
- Real estate, renting & business	(8)	100%	32,37%	2,43%	1,16%	12,68%	120,97%
- Education	(9)	100%	50,00%	0,99%	1,98%	26,73%	122,28%
- Health and social work	(10)	100%	19,39%	0,38%	0,19%	13,72%	105,87%
- Other community, social and personal service activities	(11)	100%	20,70%	2,88%	2,88%	10,35%	110,35%
Total		100%	24,04%	-	-	13,69%	110,35%

Source: Own calculations

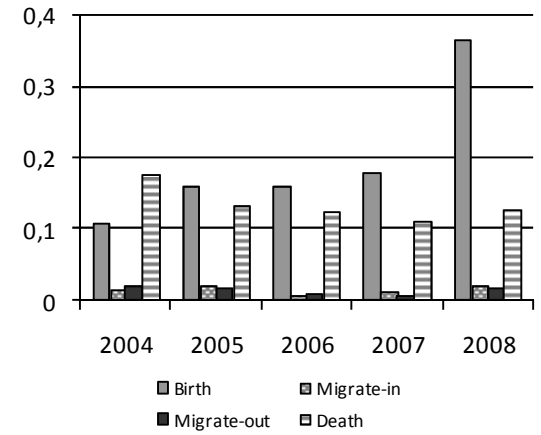
To conclude this part, it worthwhile to refer to graph 1, where changes in the number of enterprises in different sectors have been presented in a wider time span (2004-2008). Every sector is obviously characterised by its own dynamics, it should be noted however, that a sudden growth of new enterprises occurred in 2008 in all sectors (with the exception of agriculture). This phenomenon is mainly visible in the sectors of construction, transport and remaining services. The essential thing is that during the study period, practically in all sectors, the percent of new enterprises is higher than the percent of enterprises company creation is the higher amount of funding planned on the basis of structural funds for 2007-2013, in comparison to funds available during 2004-2006. Their beneficiaries are predominately small and medium enterprises.

The agricultural sector should once again be considered an exception, which, during the majority of the study period, the percent of bankrupt enterprises exceeded the percentage of newly created ones.

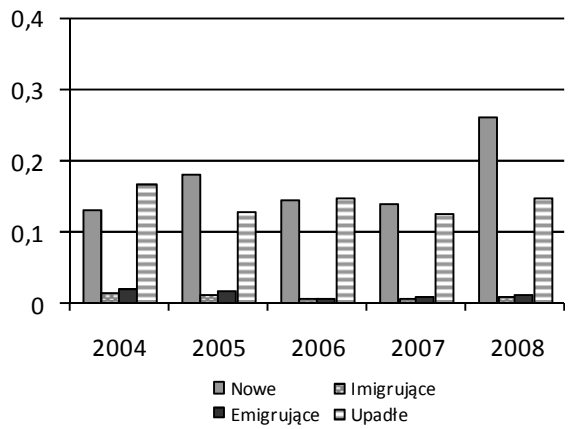
The year 2004 was exceptional in this regard, in which practically all sectors had the percentage of bankrupt enterprises exceed that of new entities. In summary, it is worthwhile to add that the percentage of enterprises migrating between sectors is considerably lower, for all sections of the economy, than the percentage of new or bankrupt enterprises.

Figure 1. Demographic evolution of enterprises between 2004-2008 (in percentages last year)

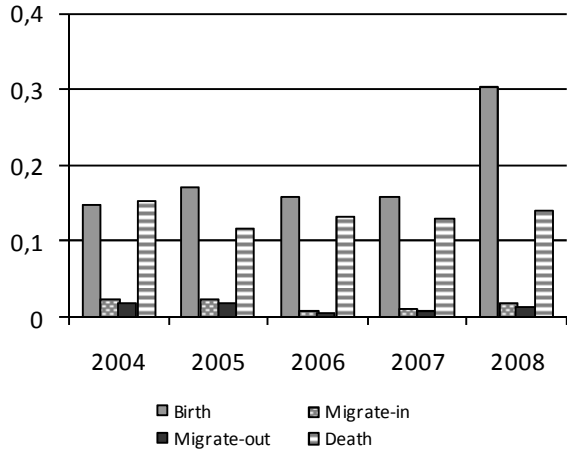
Construction



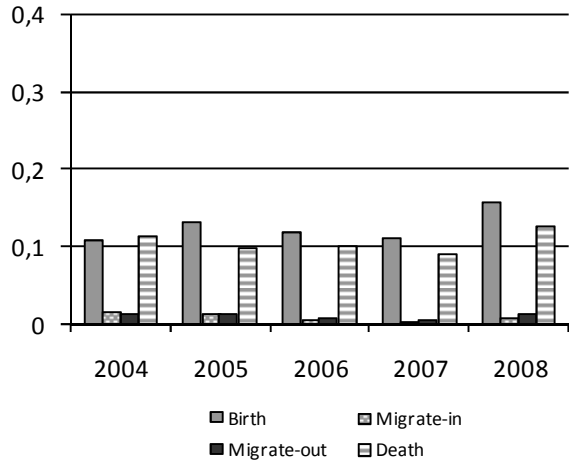
Trade



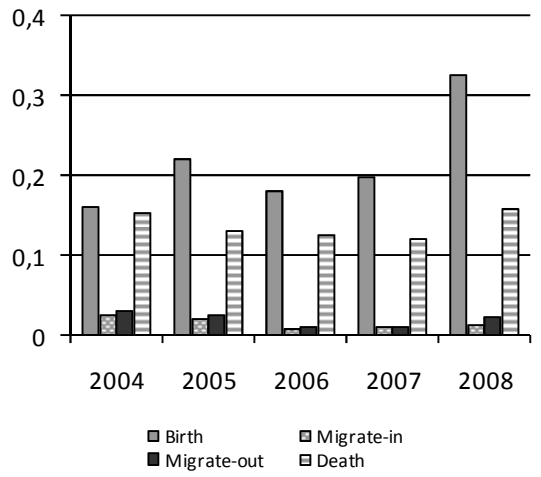
Other sernice activities



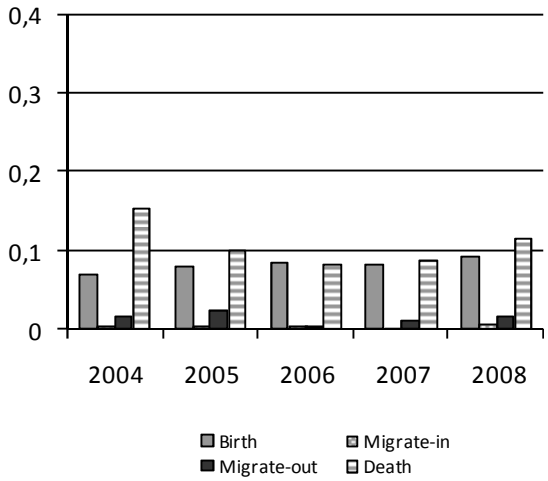
Industry



Transportation and storage and communication



Agriculture, forestry, hunting and fishery



Source: Own calculations

Association of Entrepreneurs and Employers report suggests that Polish entrepreneurs operate in difficult conditions – mainly in the area of tax solutions. Despite a reduction of CIT tax rates (from 2004 to 19%) and PIT (from 2010 to 18% and 32%), the Polish tax system is still characterised by a high level of arduousness for the taxpayers. According to the World Bank report, *Doing Business*, in 2006, businessmen had to devote an annual 175 hours for the tax authorities, however, in 2010, this number was as high as 395 hours.

5.3. Forecasting demographic change: an In-sample and out-sample test

Long-term forecasting is accomplished by means of the average transition probability matrix for 2003-2008 and the starting schedule. On this basis it was possible to conduct a forecast of the quantities in the following years. The forecast results are comparable to the distribution observed. The forecast assumed that the number of new enterprises is constant from year to year (different assumptions can be used for short-term forecasts). Based on the average matrix $D^{(t)}$, this number amounts to 7,408 enterprises. The results of the forecasts, the number of companies, separated according to sector, trade type, company size and ownership type have been presented in tables 4a and table 2a-2c of the Appendix. It is worth noting that the forecasts exhibit low *ex post* errors.

Table 4a. Forecast of the number of enterprises by principal activity for 2004-2010

Kind of activity		2004	2005	2006	2007	2008	2009	2010
Agriculture, forestry, hunting and fishery	**(1)**	**1709** (-0,059)	**1644** (-0,059)	**1587** (-0,020)	**1537** (-0,006)	**1494** (-0,014)	**1456** (0,021)	**1423**
Miting and quarrying	**(2)**	**229** (-0,038)	**234** (-0,080)	**239** (-0,057)	**243** (-0,046)	**246** (0,015)	**249** (0,090)	**252**
Manufacturing	**(3)**	**14799** (-0,031)	**15136** (-0,014)	**15437** (-0,022)	**15704** (-0,023)	**15942** (-0,010)	**16154** (-0,010)	**16342**
Electricity, gas and water supply	**(4)**	**918** (-0,013)	**927** (-0,038)	**936** (-0,023)	**945** (-0,025)	**953** (-0,005)	**962** (-0,002)	**970**
Construction	**(5)**	**4419** (-0,137)	**4605** (-0,149)	**4766** (-0,149)	**4904** (-0,103)	**5023** (0,091)	**5126** (0,104)	**5215**
Trade	**(6)**	**14739** (-0,069)	**15010** (-0,042)	**15244** (-0,063)	**15445** (-0,065)	**15618** (0,030)	**15767** (0,003)	**15896**
Hotels and restaurants	**(7)**	**727** (-0,045)	**791** (-0,038)	**844** (-0,036)	**888** (-0,052)	**924** (0,010)	**953** (0,049)	**978**
Transportation and storage and communication	**(8)**	**2217** (-0,095)	**2382** (-0,085)	**2522** (-0,091)	**2641** (-0,061)	**2741** (0,048)	**2827** (0,044)	**2899**
Financial intermediation	**(9)**	**315** (-0,132)	**326** (-0,097)	**335** (-0,138)	**341** (-0,105)	**347** (0,093)	**351** (0,260)	**354**
Real estate, renting and business	**(10)**	**5210** (-0,072)	**5480** (-0,083)	**5715** (-0,095)	**5920** (-0,107)	**6099** (0,057)	**6254** (0,043)	**6388**
Education	**(11)**	**161** (-0,141)	**187** (-0,038)	**206** (-0,037)	**221** (-0,095)	**232** (0,060)	**240** (0,100)	**247**
Health and social work	**(12)**	**938** (-0,054)	**996** (0,003)	**1047** (-0,032)	**1092** (-0,033)	**1132** (-0,012)	**1167** (0,092)	**1199**
Other community, social and personal service activities	**(13)**	**936** (-0,070)	**959** (-0,055)	**979** (-0,074)	**997** (-0,064)	**1013** (0,020)	**1028** (0,045)	**1040**
Death		**5834** (0,139)	**6046** (-0,168)	**6229** (-0,079)	**6386** (-0,202)	**6522** (0,011)	**6639** (0,053)	**6740**

Source: Own calculations
The ex post forecast errors are given in parentheses.

The authors, Coppens and Verduyn (2009) have conducted a comparison of forecasts obtained on the basis of Markov Chains with those obtained with the help of the method of average entry and average eliminations. The latter method does not take migration between sectors into account and is based on only calculating the average probabilities of entry and elimination of the company in a given category, and then multiplying that by the overall number of new companies or the number of companies in a given category in a prior period. Coppens and Verduyn reached a better forecast using

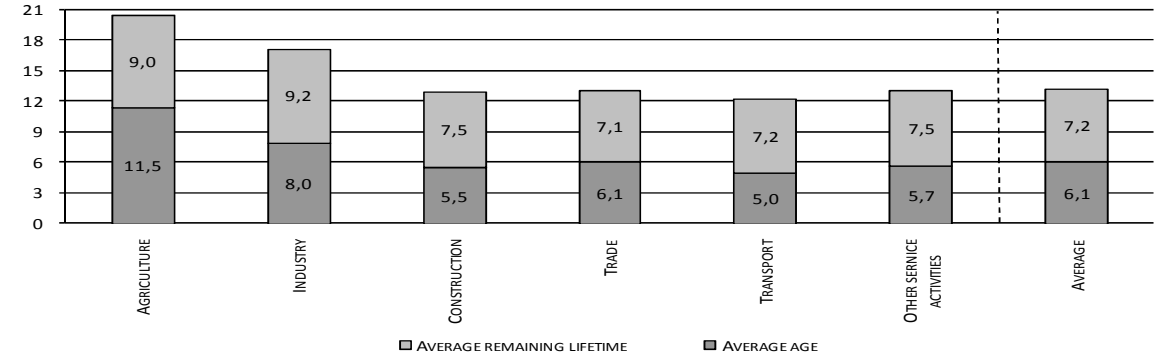
Markov Chains, taking migration among states into account. They have obtained similar results comparing both mean-square errors as well as average absolute and average relative forecast errors. Besides comparing these two forecasting method, the authors had a difficulty in drawing any further conclusions regarding their precision, since the forecast was for the same period as the data used to generate the forecasts.

When it comes to forecasting future periods, it may be an interesting solution to construct two transition matrices: one based on data from a period of high economic growth and the other from a period of low economic growth, and using one or the other matrix, depending on expectations regarding future years. This method is particularly effective in preparing short-term forecasts. For long-term forecasts or when there is a lack of clear expectations of the future, it is worthwhile to build transition matrices on data from the period, in which the economic situation underwent considerable change or was far from extreme.

5.4. Analysis of the average lifetimes and ages

Summing the elements of a row in the fundamental matrix *F*, we can answer the question, how many years (on average) will an enterprise from a given sector survive on the market. However, utilising the fundamental matrix *RF* (for a chain, in which the absorbing state is the "New" state), we obtain the average age of existing enterprises in a given sector. After summing the lifetime and average age, we obtain the average total lifetime of the enterprise on the market. Calculation results are shown on graphs 2-10 and, as to be discussed later on, they are highly similar to the results obtained on the basis of the transition matrix.

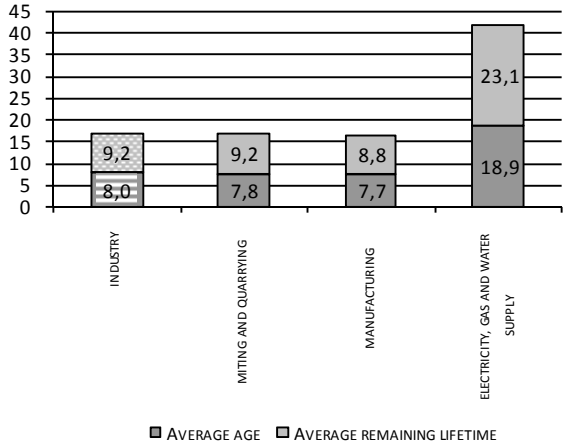
Figure 2. Average remaining lifetime and age by principal activity (six sections)



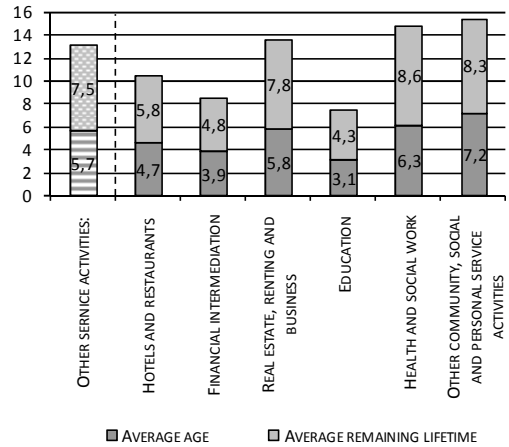
Source: Own calculations

Figure 3. Average remaining lifetime and age by sections:

Industry

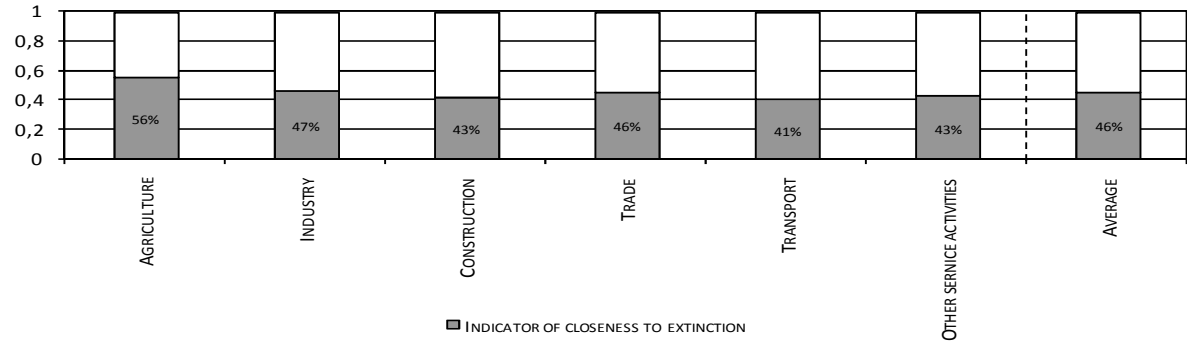


Other sernice activities



Source: Own calculations

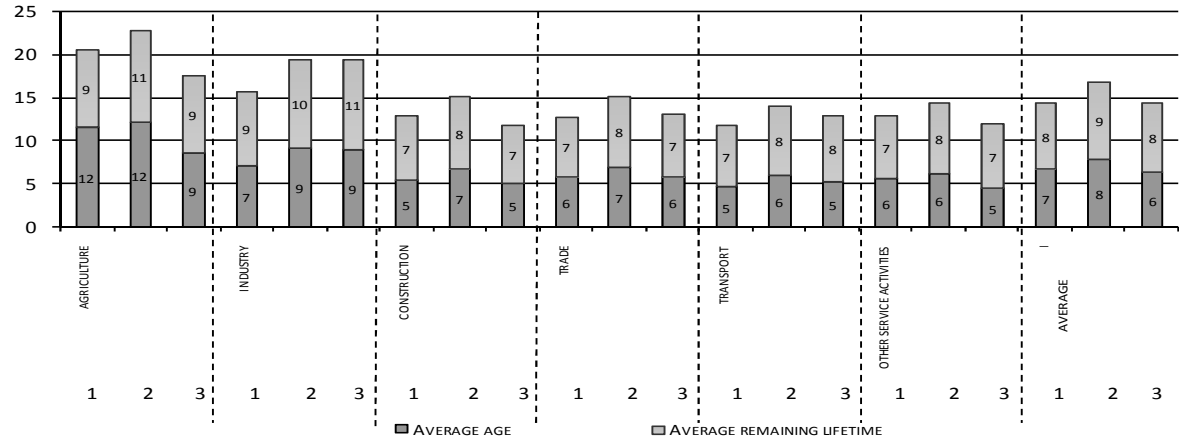
Figure 4. Average remaining lifetime and age by principal activity (six sections) in percentages



Source: Own calculations

In general, the least "survivable" companies can be considered those in the "Transport" section, then from "Construction", "Remaining services" and "Trade". The enterprises that hold onto the market the longest are those dealing with agriculture, fishing and forestry, and industrial. The average age for the entire set is 6.1 years, whereas the average expected further lifetime is 7.2 years (see graph 2). On the basis of graph 3, it can be concluded that, as part of the industrial sector, the "Electricity, gas and hydro production and supply" section stands out the most positively in terms of average age and average further lifetime – the values for this section are around 2.5 times higher than for the remaining branches of industry. When it comes to the "Remaining services" sector, the "Remaining service activity" and "Healthcare" sections stand out the most positively, whereas the sectors with the shortest average age and average lifetime are "Education" and "Financial agency services". In the case of the highlighted sections of the "Remaining services" sector, the differences in lifetime, measured in years, are considerably smaller than what took place in the case of branches of the industrial sector. It is worthwhile to mention that the average closeness to extinction of a sector in the economy amounts to 46% (see graph 4). The highest value of this indicator is characteristic of the "Agriculture, fishing etc." sector, however this amount only slightly exceeds the average value for the whole economy.

Figure 5. Average remaining lifetime and age by principal activity (six sections) and by export volume

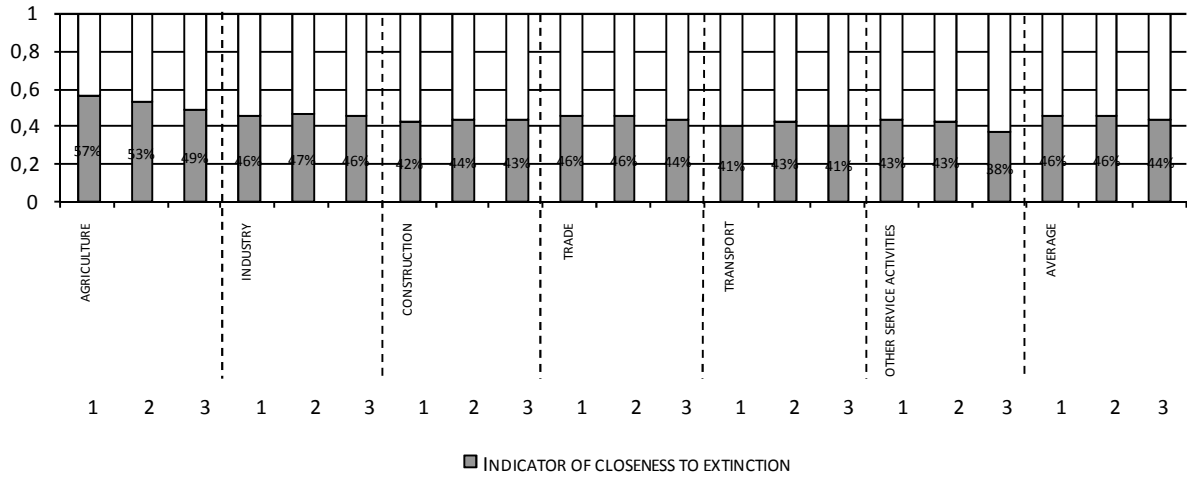


Source: Own calculations
Specification: 1- non-exporter; 2 – exporter non-specialized; 3 - exporter specialized

On the basis of graph 5, it is worthwhile to note that in all the aforementioned sectors and sections, the highest average age belongs to non-specialised exporters. What is interesting is that in the "Industry" sector, the survival times in non-specialised and specialised exporter groups are practically equal. In general, the longest survival time belongs to non-specialised exporters from the "Agriculture, fishing, etc." sector, the shortest to non-exporters in the "Transport, storage and communications" sector. When it comes to the closeness to extinction indicators, according to the trade type (see graph 6), it can be noted that, for the majority of sectors, these indicators do not differ much from the average of the whole economy. In this respect, the most notable are non-exporters from the

"Agriculture, fishing, etc." sector (the closeness to extinction indicator amounts to ca. 57%), and exporters from the "Remaining services" sector (the closeness to extinction indicator is equal for them at 38%).

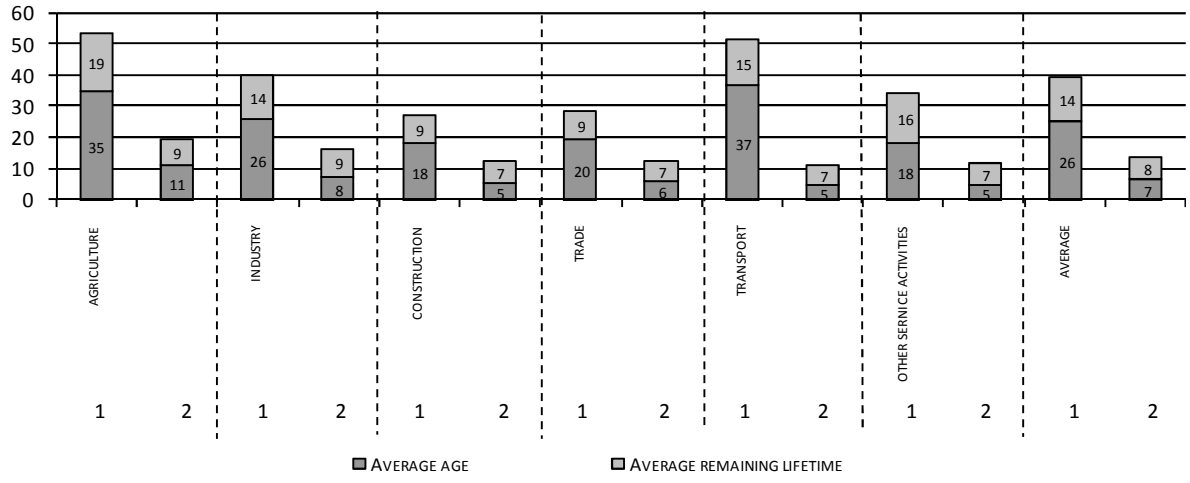
Figure 6. Average remaining lifetime and age by principal activity (six sections) and by export volume (in percentages)



Source: Own calculations
Specification: 1- non-exporter; 2 – exporter non-specialized; 3 - exporter specialized

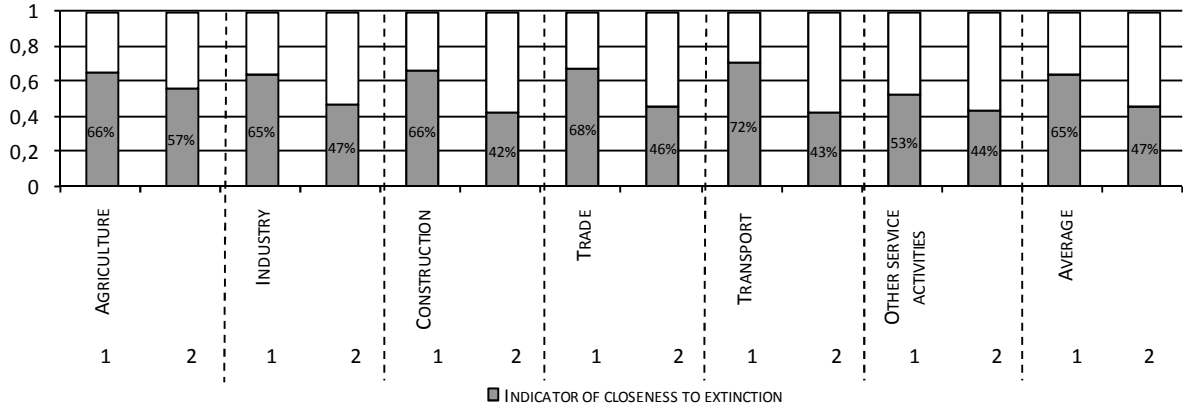
Graph 7 shows the average age and the lifetime divided according to ownership structure, however graph 8 presents closeness to extinction indicators also according to this distribution. On the basis of these graphs, it can be concluded that public-sector companies have a considerably longer average age and lifetime than their private-sector counterparts. It should be noted, however, that the advantage of public entities is much more visible in the case of the former indicator, while differences in the average survival times between the public and private sectors are considerably smaller. The highest average age belongs to public enterprises in the agricultural sector, and also transport. On the other hand, it is public companies that have the higher closeness to extinction indicators, which considerably exceed 50% in all the sectors. In the case of private companies, the closeness to extinction indicators are usually less than 50% - an exception are private agricultural companies for which the indicator amounted to 57%.

Figure 7. Average remaining lifetime and age by principal activity (six sections) and by form of ownership



Source: Own calculations
Specification: 1 – public sector, 2 – private sector

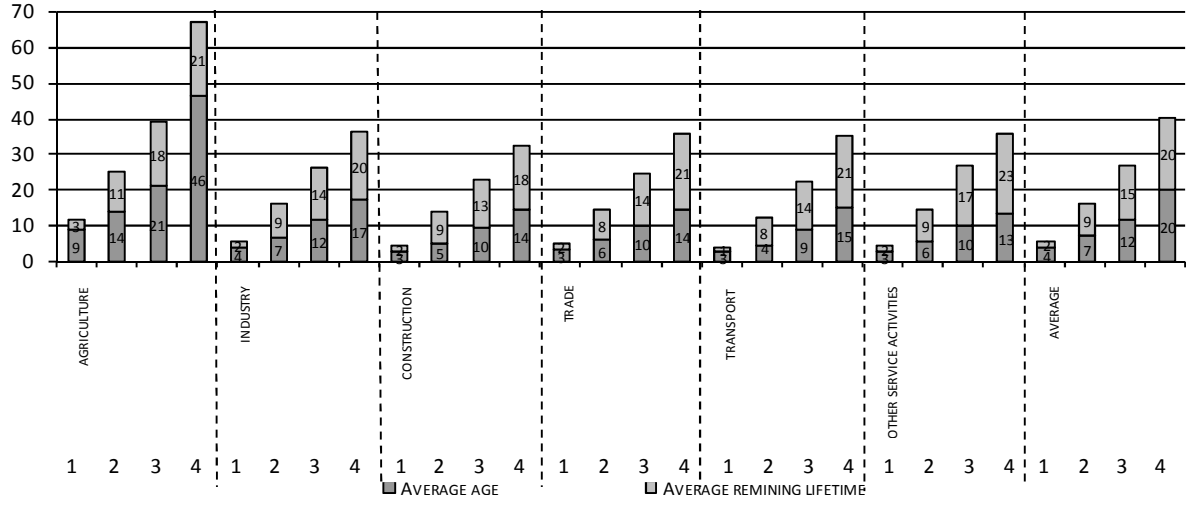
Figure 8. Average remaining lifetime and age by principal activity (six sections) and by form of ownership (in percentages)



Source: Own calculations
Specification: 1- public sector; 2 - private sector

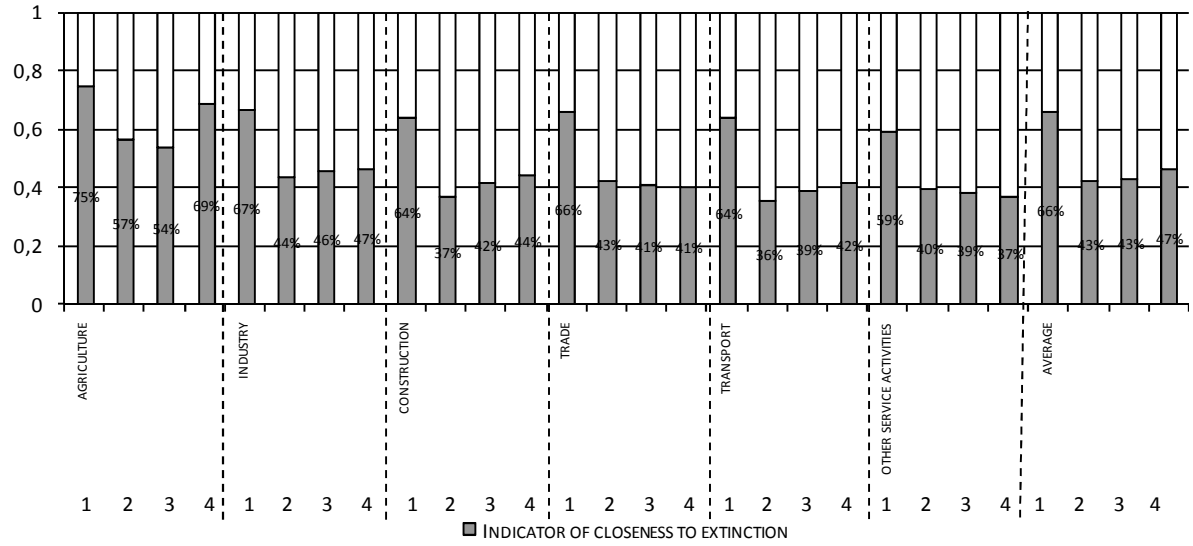
The last two graphs show the average age, average lifetime and the closeness to extinction indicators segregated by companies size. It is easy to observe the dependency that the larger the company, the longer the average age and average lifetime. The greatest differences in these values between companies of different sizes occur in the "Agriculture, fishing, etc." sector. When it comes to closeness to extinction indicators, the decidedly highest value of this indicator occurs in the group of micro-companies. What's interesting, the lowest average of this indicator in the whole economy occurs in small companies, then in medium, and only then in large ones – the differences are not significant, though. To conclude, it is worthwhile to mention that also in a cross section by the type of business activity, the differences in the values of the closeness to extinction indicator between small, medium and large companies are usually small – the exception is agriculture in which large companies have around a 15 percentage point higher closeness to extinction indicator than mid-sized entities and around a 12 percentage points higher than small entities.

Figure 9. Average remaining lifetime and age by principal activity (six sections) and by class size



Source: Own calculations
Specification: 1 - micro, 2 – small, 3 – medium, 4 – large

Figure 10. Average remaining lifetime and age by principal activity (six sections) and by class size (in percentages)



Source: Own calculations
Specification: 1 – micro, 2 – small, 3 – medium, 4 – large

Conclusions

The present study has attempted to apply the Markov Chains mathematical theory to analyse the demographic evolution of Polish enterprises in the years 2003-2009. Other methods of studying these problems in empirical literature include the calculation of descriptive statistics for the levels of entry/exit of enterprises, binary variable models and the analysis of survival. None of these methods accounts for migration between branches of the economy. The methodology based on Markov Chains takes into account changes in business activity, and, as a consequence, gives a fuller picture of the demographic evolution of the enterprise population.

The study took advantage of the data of the Central Statistical Office, form F-02 – statistical financial reports. The definitions of states have been assumed in accordance with international methods described by Eurostat/OECD (2007).

Research on enterprise demographics can be an important reference point for economists who evaluate the mechanisms of monetary policy transmission. Monetary shocks, aside from real, lead to two kinds of adjustments in the enterprise sector. These can be adjustments of a quantitative nature, where the change of the aggregate product is an effect of change in the number of companies, or adjustments of a qualitative nature, where the change in the aggregate product takes place as a result of changes to production costs and the productivity of companies already active on the market.

In striving to ensure a stable growth of the national economy, the attention of those governing should not only be focused on macroeconomic indicators, but also on institutional and legal solutions that shape the background in which economic entities operate. Its state (the level and quality of regulations occurring in the market) directly translates into the ease of establishing and managing business activity. Demographic research of enterprises provides a picture of the weak elasticity of Polish companies in the changing economic conditions. The migration level between sectors is low and limited to only several sectors, while the expected lifetime of a company is relatively short (on average, Polish companies live more than twice as short as, e.g. Belgian companies, as studied by the National Bank of Belgium[18]). Poland remains a country of a high level of regulation in economic life. This is indicated by reports from the World Bank[19] (*Doing Business 2011*), as well as the *Product*

[18] Coppens i Verduyn (2009)
[19] Our country received the worst evaluation in the following categories: obtaining construction permits (164th place; 32 procedures are required, their realisation takes 311 days), paying taxes (121st place; 29 payments, 325 hours, total tax rate: 42,3% of income) and starting business activity (113th place; 6 procedures, 32 days).

Market Regulation index[20], prepared by the OECD. The reports acknowledge the high barriers to starting new enterprises and inertia in the economy, related to making entry and exit difficult for enterprises in the national market.

The results of demographic research can also be helpful to future businessmen in making decisions on starting a business. The character of the business conducted by the company (form of ownership, sector, number of employees, trade type) has an important influence on the changes of making it on the market (abstracting from the financial effectiveness of companies active in particular sectors). Generally, the least "survivable" companies can be regarded the ones from the "Transport" section, then from "Construction", "Remaining services" and "Trade". Enterprises surviving the longest in the market are those dealing in agriculture, fishing and forestry and industrial companies. The average closeness to extinction indicator in the economy amounts to 46%. All the highlighted sectors and sections, the highest average age belongs to non-specialised exporters. Public companies have a considerably higher average age and lifetime than private companies. The larger the company, the higher the average age, as well as the average lifetime.

Summing up, the Markov Chain methodology can have a wide use in studying the evolution of the structure and size of the enterprise set. Most importantly, it provides the possibility of analysing the former characteristic by acknowledging enterprise migration between different kinds of business activity. It has already been empirically proven that migrations of this type are of prime importance in shaping domestic product. In a similar way, the number of enterprises, the number of employees, or Gross Value Added can be studied. Forecasts using the transition matrix produce better results than methods that do not account for migration. On the basis of a proper fundamental matrix, the average lifetime and the average age of a company from a given category can also be calculated, which may be used as a basis for other conclusions, concerning not only the economy as a whole, but also its individual building blocks.

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Appendix

Table 1a. Enterprise migrations between 2007-2008 by principal activity (six sections), table $D^{(t)}$

Kind of activity		1	2	3	4	5	6	Death	Total
Agriculture, forestry, hunting and fishery	(1)	**1 321**	9	6	9	1	2	180	1 528
Industry	(2)	3	**14 219**	40	87	9	52	2 098	16 508
Construction	(3)	1	21	**3 811**	12	3	34	565	4 447
Trade	(4)	4	86	22	**12 189**	18	46	2 133	14 498
Transportation and storage and communication	(5)	0	8	11	20	**2 037**	16	396	2 488
Other sernice activities	(6)	2	32	17	23	4	**7 394**	1 224	8 696
Birth		142	2 609	1 619	3 761	809	2 639	0	11 579
Total		1 473	16 984	5 526	16 101	2 881	10 183	6 596	

Source: Own calculations

Table 1b. Enterprise migrations between 2007-2008 by principal activity (13 sections), table $D^{(t)}$

Kind of activity		1	2	3	4	5	6	7	8	9	10	11	12	13	Death	Total
Agriculture, forestry, hunting and fishery	(1)	**1 321**	0	8	1	6	9	1	1	0	1	0	0	0	180	1 528
Industry:																
- Miting and quarrying	(2)	0	**201**	2	0	2	0	0	0	0	0	0	0	0	27	232
- Manufacturing	(3)	3	3	**13 140**	2	33	87	8	0	2	29	1	0	3	2043	15 354
- Electricity, gas and water supply	(4)	0	0	0	**871**	5	0	1	0	0	2	0	0	15	28	922
Construction	(5)	1	0	20	1	**3 811**	12	3	1	1	31	0	0	1	565	4 447
Trade	(6)	4	0	83	3	22	**12 189**	18	3	3	39	0	1	0	2133	14 498
Transportation and storage and communication	(7)	0	0	8	0	11	20	**2 037**	1	0	11	0	0	4	396	2 488
Other sernice activities:																
- Hotels and restaurants	(8)	0	0	0	0	0	6	0	**652**	2	2	0	1	0	181	844
- Financial intermediation	(9)	0	0	2	0	1	2	0	0	**233**	2	0	0	0	69	309
- Real estate, renting and business	(10)	1	1	15	1	14	13	4	4	2	**4 607**	1	2	4	678	5 347
- Education	(11)	0	0	0	0	0	1	0	0	0	3	**144**	0	0	54	202
- Heath and social work	(12)	0	0	0	0	0	0	0	1	0	1	0	**910**	0	145	1 057
- Other community, social and personal service activities	(13)	1	1	0	12	2	1	0	1	0	9	0	0	**813**	97	937
Birth		142	44	2507	58	1619	3761	809	269	139	1731	101	205	194	0	11 579
Total		1 473	250	15 785	949	5 526	16 101	2 881	933	382	6 468	247	1 119	1 034	6 596	

Source: Own calculations

Table 1c. Enterprise migrations between 2007-2008 by principal activity (6 sections) and by export volume , table $D^{(t)}$

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Death	Total
Agriculture, forestry, hunting and fishery																					
- non-exporter	(1)	**1128**	**31**	**1**	6	0	0	5	0	0	6	0	0	1	0	0	0	0	0	162	1340
- exporter non-specialized	(2)	**30**	**87**	**7**	0	2	0	0	0	0	2	0	0	0	0	0	1	0	0	8	137
- exporter specialized	(3)	**4**	**3**	**30**	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	10	51
Industry																					
- non-exporter	(4)	0	0	0	**5519**	**682**	**135**	31	0	1	36	4	0	8	0	0	35	2	0	1245	7698
- exporter non-specialized	(5)	1	2	0	**843**	**4286**	**187**	3	5	0	11	28	4	0	0	0	6	6	0	535	5917
- exporter specialized	(6)	0	0	0	**179**	**255**	**2133**	0	0	0	1	0	3	0	0	1	0	0	3	318	2893
Construction																					
- non-exporter	(7)	1	0	0	14	2	0	**3321**	**67**	**22**	7	0	1	3	0	0	27	1	0	512	3978
- exporter non-specialized	(8)	0	0	0	1	2	0	**104**	**194**	**5**	1	2	0	0	0	0	2	4	0	17	332
- exporter specialized	(9)	0	0	0	0	0	2	**13**	**13**	**72**	0	1	0	0	0	0	0	0	0	36	137
Trade																					
- non-exporter	(10)	3	0	0	40	6	1	18	1	0	**8604**	**521**	**22**	10	1	1	37	1	0	1823	11089
- exporter non-specialized	(11)	0	1	0	4	27	2	1	2	0	**663**	**2131**	**23**	1	2	0	3	5	0	266	3131
- exporter specialized	(12)	0	0	0	1	0	5	0	0	0	**23**	**38**	**164**	0	1	2	0	0	0	44	278
Transportation and storage and communication																					
- non-exporter	(13)	0	0	0	5	1	0	11	0	0	14	0	0	**1174**	**96**	**45**	13	0	0	293	1652
- exporter non-specialized	(14)	0	0	0	0	1	0	0	0	0	1	4	0	**114**	**314**	**33**	2	0	0	51	520
- exporter specialized	(15)	0	0	0	0	1	0	0	0	0	0	0	1	**47**	**25**	**189**	0	1	0	52	316
Other sernice activities																					
- non-exporter	(16)	2	0	0	21	1	1	13	1	0	17	0	0	3	0	0	**6318**	**165**	**23**	1108	7673
- exporter non-specialized	(17)	0	0	0	1	6	0	0	1	0	1	4	0	0	0	0	**163**	**467**	**16**	78	737
- exporter specialized	(18)	0	0	0	0	1	1	2	0	0	0	0	1	0	0	1	**23**	**24**	**195**	38	286
Birth		123	10	9	1830	473	306	1538	46	35	3217	466	78	647	82	80	2373	161	105	0	11579
Total		1292	134	47	8465	5746	2773	5060	330	136	12604	3200	297	2008	521	352	9003	837	343	6596	

Source: Own calculations

Table 1d. Enterprise migrations between 2007-2008 by principal activity (six sections) and by size class, table $D^{(t)}$

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Death	Total
Agriculture, forestry, hunting and fishery																											
- *micro*	(1)	**15**	**12**	**0**	**0**	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73	101
- *small*	(2)	**44**	**1016**	**7**	**0**	0	5	0	0	0	4	2	0	0	8	0	0	0	1	0	0	0	0	0	0	96	1183
- *medium*	(3)	**0**	**22**	**181**	**1**	0	2	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	9	219
- *large*	(4)	**0**	**1**	**1**	**21**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	25
Industry																											
- *micro*	(5)	0	0	0	0	**5**	**18**	**1**	**0**	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	258	283
- *small*	(6)	0	0	0	0	**105**	**5744**	**277**	**2**	0	22	1	0	3	48	2	0	1	6	0	0	0	27	1	0	1197	7436
- *medium*	(7)	0	1	2	0	**10**	**389**	**5772**	**114**	0	0	16	0	0	4	25	0	0	0	2	0	0	2	16	0	594	6947
- *large*	(8)	0	0	0	0	**6**	**3**	**164**	**1609**	1	0	0	0	0	0	0	4	0	0	0	0	0	1	2	3	49	1842
Construction																											
- *micro*	(9)	0	0	0	0	0	0	0	0	**6**	**8**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	120	134
- *small*	(10)	0	1	0	0	1	11	1	0	**46**	**2074**	**129**	**1**	0	9	0	0	0	1	1	0	0	23	0	0	342	2640
- *medium*	(11)	0	0	0	0	0	1	6	0	**5**	**101**	**1255**	**10**	0	0	2	0	0	0	1	0	0	2	6	0	100	1489
- *large*	(12)	0	0	0	0	0	0	0	1	**1**	**2**	**18**	**155**	0	0	0	1	0	0	0	0	0	1	1	1	3	184
Trade																											
- *micro*	(13)	0	0	0	0	0	1	1	0	0	0	0	0	**28**	**42**	**0**	**0**	0	0	0	0	0	0	0	0	465	537
- *small*	(14)	1	3	0	0	3	39	3	0	0	18	1	0	**185**	**8539**	**274**	**0**	2	5	0	0	1	33	1	0	1430	10538
- *medium*	(15)	0	0	0	0	0	5	24	6	0	0	2	0	**10**	**166**	**2493**	**48**	0	1	10	0	0	2	6	1	220	2994
- *large*	(16)	0	0	0	0	0	0	0	4	0	0	0	1	**5**	**1**	**19**	**379**	0	0	0	0	0	0	1	1	18	429
Transportation and storage and communication																											
- *micro*	(17)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0**	**2**	**0**	**0**	0	0	0	0	71	74
- *small*	(18)	0	0	0	0	0	4	0	0	1	7	0	0	0	14	0	0	**41**	**1093**	**36**	**1**	0	8	4	0	258	1467
- *medium*	(19)	0	0	0	0	0	0	2	0	0	0	3	0	0	0	5	0	**4**	**42**	**589**	**15**	0	1	1	0	63	725
- *large*	(20)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	**2**	**0**	**4**	**208**	0	0	0	2	4	222
Other sernice activities																											
- *micro*	(21)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**24**	**25**	**1**	**0**	383	433
- *small*	(22)	0	1	0	0	0	15	1	1	1	14	0	0	1	17	1	0	0	2	0	0	**123**	**4304**	**150**	**0**	699	5330
- *medium*	(23)	0	0	1	0	0	1	11	1	0	0	2	0	0	1	3	0	0	0	2	0	**3**	**111**	**2048**	**46**	129	2359
- *large*	(24)	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**3**	**40**	**516**	13	574
Birth		36	98	8	0	286	1808	464	51	207	1257	152	3	552	2949	243	17	92	615	95	7	609	1722	264	44		11579
Total		96	1155	200		416	8048	6729	1791	268	3507	1581	170	785	11799	3067	450	142	1768	740	231	760	6265	2544	614	6596	

Source: Own calculations

Table 1e. Enterprise migrations between 2007-2008 by principal activity (six sections) and by form of ownership, table $D^{(t)}$

		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Death**	**Total**
Agriculture, forestry, hunting and fishery															
- public sector	(1)	**105**	1	1	0	0	0	0	0	0	0	1	0	6	114
- private sector	(2)	1	**1214**	0	8	0	6	0	9	0	1	0	1	174	1414
Industry															
- public sector	(3)	0	0	**1076**	45	1	0	0	1	0	0	18	0	68	1209
- private sector	(4)	0	3	7	**13086**	1	38	0	86	0	9	0	34	2029	15293
Construction															
- public sector	(5)	0	0	1	0	**117**	5	0	0	0	0	3	0	12	138
- private sector	(6)	0	1	0	20	1	**3688**	0	12	0	3	0	31	553	4309
Trade															
- public sector	(7)	0	0	3	1	0	0	**102**	5	0	0	1	0	14	126
- private sector	(8)	0	4	0	82	0	22	1	**12080**	0	18	0	45	2119	14371
Transportation and storage and communication															
- public sector	(9)	0	0	0	0	0	0	1	0	**280**	8	2	0	14	305
- private sector	(10)	0	0	0	8	0	11	0	19	0	**1748**	0	14	382	2182
Other sernice activities															
- public sector	(11)	0	0	14	0	0	0	0	0	0	0	**988**	13	76	1091
- private sector	(12)	0	2	0	18	0	17	0	23	0	4	4	**6384**	1148	7600
Birth		4	138	58	2551	16	1603	5	3756	13	796	93	2545		11578
Total		110	1363	1160	15819	136	5390	109	15991	293	2587	1110	9067	6595	

Source: Own calculations

Table 2a. Forecast of the number of enterprises by principal activity (six sections) and by export volume for 2004-2010

	2004	2005	2006	2007	2008	2009	2010
Agriculture, forestry, hunting and fishery							
- non-exporter	**1533** (-0,071)	**1459** (-0,066)	**1397** (-0,026)	**1345** (-0,004)	**1302** (-0,008)	**1266** (0,038)	**1234**
- exporter non-specialized	**138** (0,050)	**143** (0,015)	**145** (0,045)	**146** (-0,063)	**145** (-0,082)	**144** (-0,177)	**142**
- exporter specialized	**38** (-0,034)	**43** (-0,094)	**46** (-0,063)	**48** (0,063)	**49** (-0,044)	**50** (0,022)	**50**
Industry							
- non-exporter	**7876** (-0,044)	**7941** (-0,032)	**8020** (-0,057)	**8104** (-0,053)	**8189** (0,033)	**8270** (-0,023)	**8346**
- exporter non-specialized	**5395** (0,002)	**5604** (0,005)	**5776** (0,010)	**5921** (-0,001)	**6045** (-0,052)	**6153** (-0,015)	**6248**
- exporter specialized	**2648** (-0,044)	**2713** (-0,003)	**2775** (0,017)	**2831** (0,021)	**2883** (-0,040)	**2930** (0,046)	**2973**
Construction							
- non-exporter	**3974** (-0,149)	**4145** (-0,156)	**4291** (-0,161)	**4416** (-0,110)	**4523** (0,106)	**4615** (0,111)	**4694**
- exporter non-specialized	**318** (-0,034)	**328** (-0,080)	**339** (-0,044)	**350** (-0,053)	**359** (-0,088)	**368** (-0,156)	**375**
- exporter specialized	**127** (-0,057)	**131** (-0,104)	**135** (-0,080)	**138** (-0,009)	**141** (-0,036)	**143** (0,334)	**145**
Trade							
- non-exporter	**11690** (-0,075)	**11758** (-0,041)	**11851** (-0,069)	**11953** (-0,078)	**12053** (0,044)	**12149** (-0,017)	**12236**
- exporter non-specialized	**2773** (-0,036)	**2955** (-0,039)	**3088** (-0,035)	**3186** (-0,018)	**3262** (-0,019)	**3322** (0,068)	**3369**
- exporter specialized	**254** (-0,071)	**268** (-0,044)	**279** (-0,037)	**287** (-0,034)	**294** (0,011)	**299** (0,039)	**303**
Transportation and storage and communication							
- non-exporter	**1435** (-0,077)	**1593** (-0,058)	**1713** (-0,099)	**1805** (-0,093)	**1878** (0,065)	**1936** (-0,011)	**1984**
- exporter non-specialized	**458** (0,017)	**483** (-0,099)	**507** (-0,037)	**529** (-0,017)	**548** (-0,052)	**566** (0,040)	**581**
- exporter specialized	**329** (-0,449)	**310** (-0,244)	**303** (-0,144)	**303** (0,040)	**307** (0,129)	**311** (0,311)	**316**
Other sernice activities							
- non-exporter	**7398** (-0,063)	**7780** (-0,055)	**8111** (-0,074)	**8397** (-0,094)	**8645** (0,040)	**8861** (0,023)	**9047**
- exporter non-specialized	**674** (-0,099)	**711** (-0,084)	**747** (-0,100)	**779** (-0,057)	**807** (0,036)	**832** (0,136)	**853**
- exporter specialized	**210** (-0,256)	**242** (-0,367)	**265** (-0,182)	**281** (0,016)	**294** (0,144)	**303** (0,505)	**310**

Source: Own calculations

The ex post forecast errors are given in parentheses.

Table 2b . Forecast of the number of enterprises by principal activity (six sections) and by size class for 2004-2010

	2004	2005	2006	2007	2008	2009	2010
Agriculture, forestry, hunting and fishery							
- small	**1306** (-0,039)	**1266** (-0,024)	**1230** (-0,018)	**1198** (-0,012)	**1169** (-0,012)	**1144** (0,025)	**1122**
- medium	**216** (-0,005)	**214** (-0,029)	**212** (0,010)	**209** (0,043)	**207** (-0,035)	**205** (-0,051)	**202**
- large	**31** (-0,032)	**28** (-0,009)	**26** (0,006)	**24** (0,051)	**22** (0,007)	**20** (0,286)	**19**
Industry							
- small	**7311** (-0,045)	**7520** (-0,018)	**7693** (-0,033)	**7836** (-0,054)	**7956** (0,011)	**8058** (0,064)	**8144**
- medium	**6525** (-0,004)	**6627** (-0,004)	**6730** (0,000)	**6833** (0,016)	**6933** (-0,030)	**7030** (-0,043)	**7122**
- large	**1657** (-0,015)	**1697** (-0,030)	**1735** (-0,005)	**1773** (0,038)	**1809** (-0,010)	**1844** (-0,110)	**1878**
Construction							
- small	**2665** (-0,163)	**2781** (-0,172)	**2877** (-0,187)	**2957** (-0,120)	**3024** (0,138)	**3081** (0,182)	**3130**
- medium	**1358** (-0,080)	**1424** (-0,102)	**1488** (-0,071)	**1549** (-0,040)	**1606** (-0,016)	**1659** (-0,001)	**1708**
- large	**156** (-0,078)	**162** (-0,001)	**168** (0,050)	**174** (0,052)	**181** (-0,064)	**187** (-0,147)	**194**
Trade							
- small	**10907** (-0,065)	**11049** (-0,037)	**11176** (-0,059)	**11289** (-0,071)	**11390** (0,035)	**11480** (0,035)	**11561**
- medium	**2706** (-0,036)	**2820** (-0,047)	**2924** (-0,055)	**3018** (-0,008)	**3104** (-0,012)	**3182** (0,004)	**3253**
- large	**321** (-0,029)	**356** (-0,068)	**389** (-0,047)	**422** (0,017)	**453** (-0,006)	**482** (0,129)	**511**
Transportation and storage and communication							
- small	**1284** (-0,127)	**1404** (-0,098)	**1498** (-0,095)	**1574** (-0,073)	**1634** (0,076)	**1682** (0,099)	**1721**
- medium	**617** (-0,017)	**651** (-0,049)	**685** (-0,057)	**719** (0,008)	**751** (-0,015)	**782** (0,036)	**811**
- large	**209** (-0,026)	**215** (-0,035)	**221** (-0,025)	**228** (-0,027)	**235** (-0,016)	**242** (-0,080)	**249**
Other sernice activities							
- small	**5109** (-0,065)	**5382** (-0,059)	**5613** (-0,075)	**5809** (-0,090)	**5978** (0,046)	**6122** (0,118)	**6246**
- medium	**2170** (-0,039)	**2267** (-0,051)	**2363** (-0,047)	**2457** (-0,042)	**2548** (-0,002)	**2636** (0,024)	**2720**
- large	**453** (-0,037)	**495** (-0,072)	**537** (-0,082)	**576** (-0,004)	**615** (-0,002)	**652** (-0,019)	**689**

Source: Own calculations

The ex post forecast errors are given in parentheses.

Table 2c. Forecast of the number of enterprises by principal activity (six sections) and by form of ownership for 2004-2010

	2004	2005	2006	2007	2008	2009	2010
Agriculture, forestry, hunting and fishery							
- public sector	**127** (0,012)	**122** (-0,027)	**118** (0,007)	**114** (-0,002)	**111** (-0,006)	**107** (-0,012)	**104**
- private sector	**1582** (-0,064)	**1521** (-0,061)	**1468** (-0,021)	**1422** (-0,005)	**1383** (-0,014)	**1348** (0,024)	**1318**
Industry							
- public sector	**1455** (-0,0106	**1372** (-0,0496	**1296** (-0,0306)	**1229** (-0,0162)	**1167** (-0,006)	**1112** (0,014)	**1063**
- private sector	**14503** (-0,0327	**14942** (-0,0149	**15329** (-0,0232)	**15671** (-0,0247)	**15972** (-0,009)	**16237** (-0,009)	**16471**
Construction							
- public sector	**203** (-0,032)	**182** (-0,049)	**163** (-0,027)	**148** (-0,075)	**136** (0,001)	**126** (-0,074)	**117**
- private sector	**4215** (-0,142)	**4423** (-0,153)	**4602** (-0,154)	**4756** (-0,103)	**4888** (0,093)	**5001** (0,107)	**5098**
Trade							
- public sector	**172** (-0,077)	**153** (-0,085)	**137** (-0,030)	**124** (0,016)	**113** (-0,037)	**104** (-0,196)	**97**
- private sector	**14566** (-0,068)	**14858** (-0,042)	**15109** (-0,063)	**15325** (-0,066)	**15511** (0,030)	**15670** (0,003)	**15808**
Transportation and storage and communication							
- public sector	**373** (-0,047)	**350** (-0,073)	**329** (-0,041)	**310** (-0,016)	**293** (0,001)	**277** (0,085)	**263**
- private sector	**1854** (-0,110)	**2044** (-0,093)	**2201** (-0,102)	**2330** (-0,068)	**2438** (0,057)	**2526** (0,046)	**2599**
Other sernice activities							
- public sector	**1111** (0,004)	**1114** (-0,003)	**1116** (-0,023)	**1118** (-0,024)	**1119** (-0,007)	**1119** (0,006)	**1118**
- private sector	**7177** (-0,083)	**7623** (-0,074)	**8002** (-0,087)	**8324** (-0,095)	**8597** (0,051)	**8830** (0,070)	**9027**

Source: Own calculations

The ex post forecast errors are given in parentheses.

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